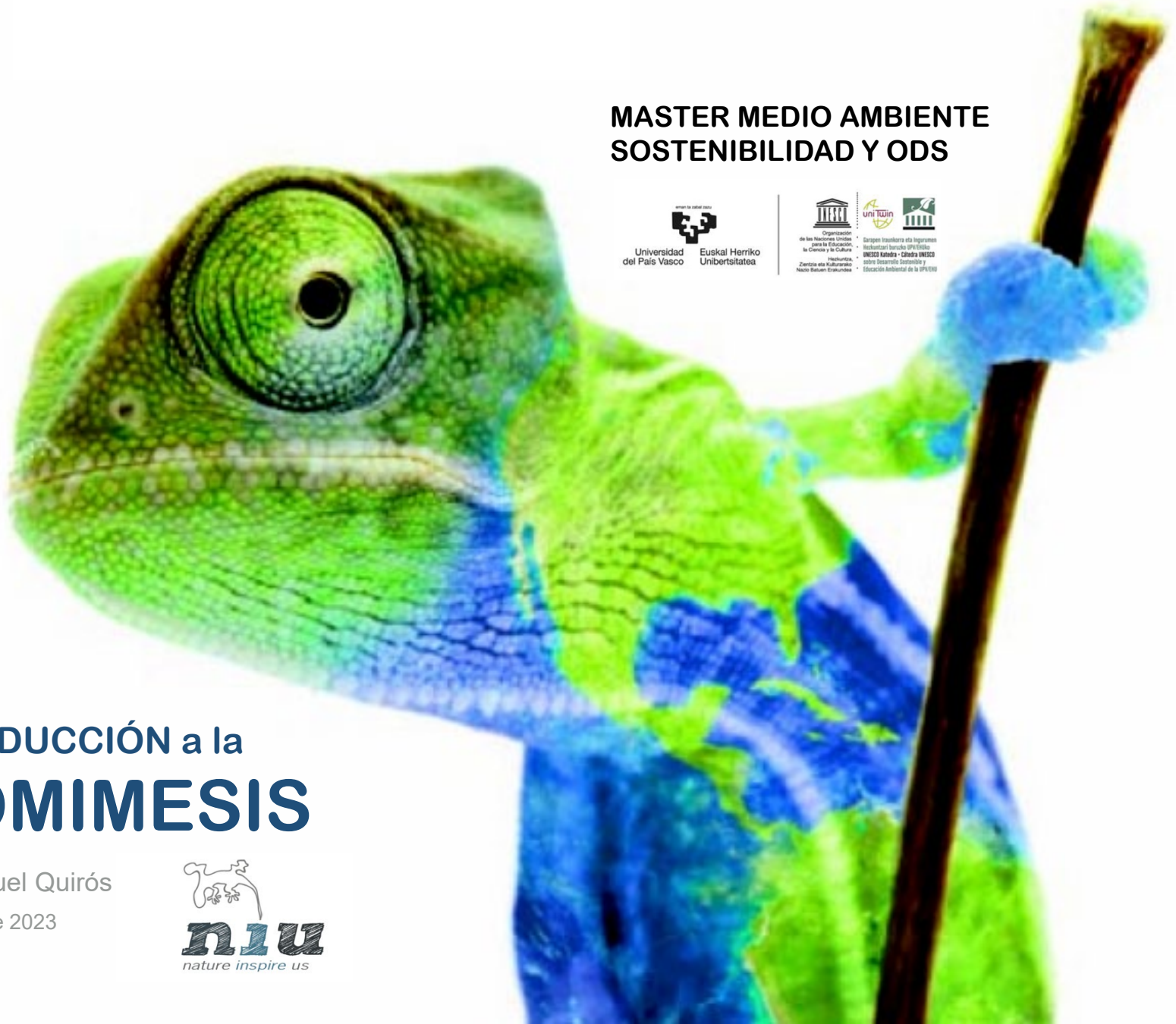
MASTER MEDIO AMBIENTE
SOSTENIBILIDAD Y ODS



INTRODUCCIÓN a la

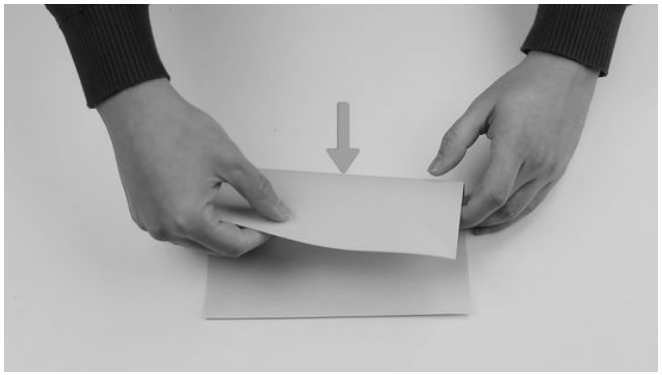
BIOMIMESIS

Dr. Manuel Quirós

Noviembre 2023

nature inspire us

origami”



PROGRAMA DIA 1 16 ▯00-20 ▯00

Conociéndonos + Plan

Porque ahora?
Biomimesis: Definición, Filosofía y Fundamentos

Casos de éxito

Q+A mini descanso + Juego_Reto

PROGRAMA DIA 2 16 ▯00▯□0▯□0

Principios de Vida

Recursos

Despedida

Manuel Quirós

natureinspireus.com

- *BSc, MSc, PhD* Biology
  postdoc + 10 years

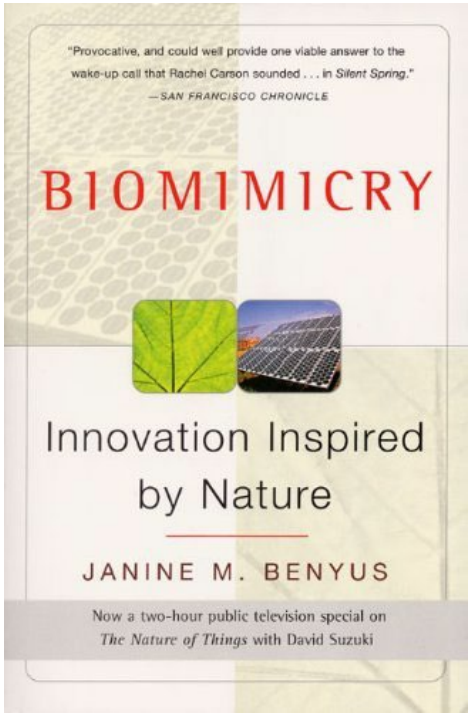
- Professor: *ExS* + Biomimicry Innovation, CSR...

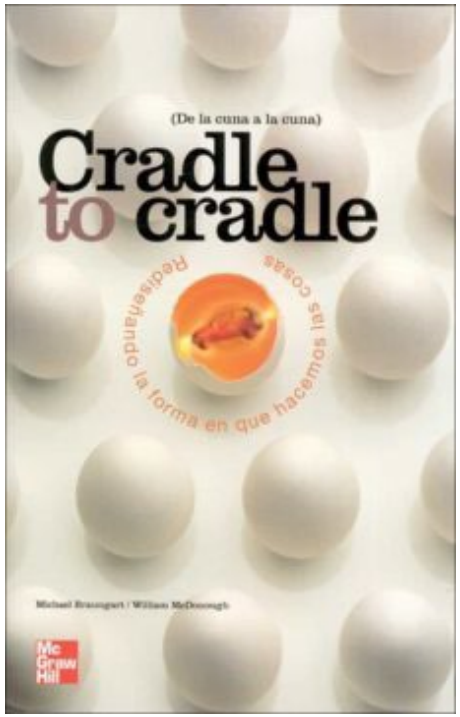
- Founder
  BIA & RI³ biomimicry

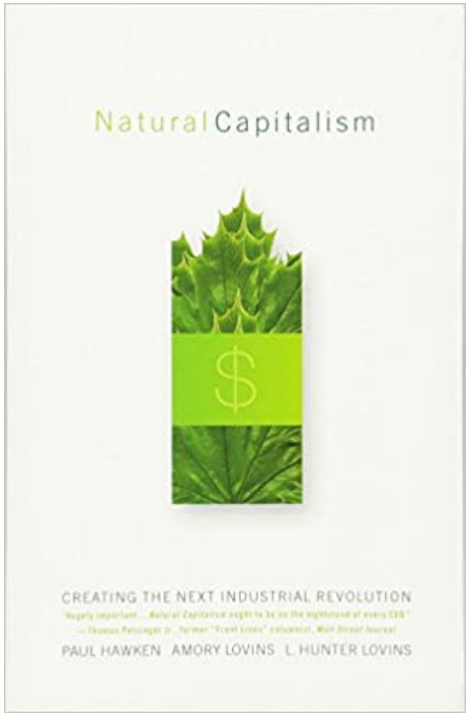
- Consultant natureinspireus
- Blog author

- Zygote Quarterly Journal

- + 140 publications (scientific, divulgation, summits, media)


"Provocative, and could well provide one viable answer to the wake-up call that Rachel Carson sounded . . . in *Silent Spring*."
—SAN FRANCISCO CHRONICLE
BIOMIMICRY
Innovation Inspired by Nature
JANINE M. BENYUS
Now a two-hour public television special on *The Nature of Things* with David Suzuki


(De la cuna a la cuna)
Cradle to cradle
rediseñando la forma en que hacemos las cosas
Mc Graw Hill


Natural Capitalism
$
CREATING THE NEXT INDUSTRIAL REVOLUTION
PAUL HAWKEN AMORY LOVINS L. HUNTER LOVINS

Conociéndonos + Plan + Retos

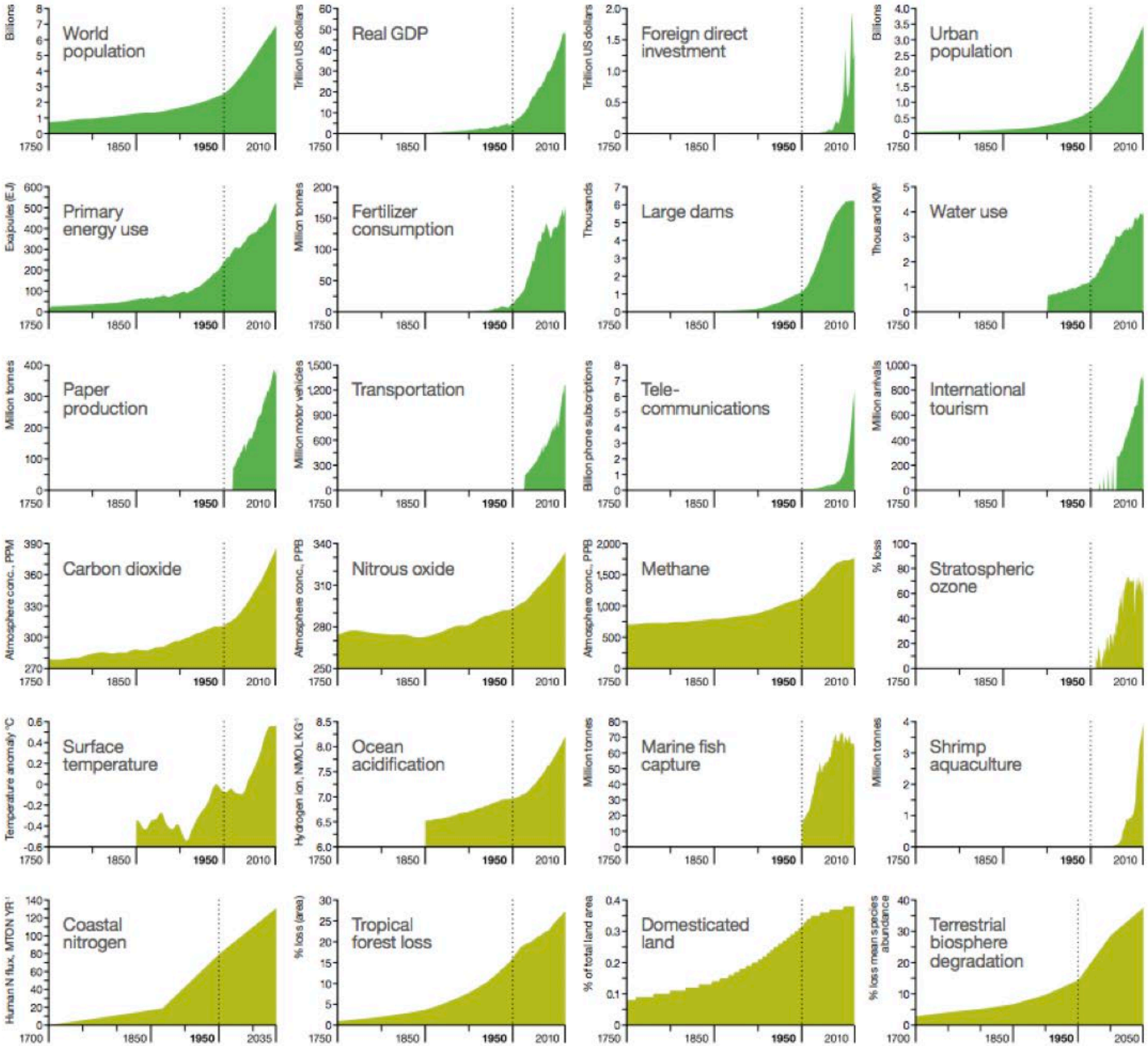
Porque ahora?
Biomimesis: Definición, Filosofía y Fundamentos

Casos de éxito + Reto I

Q+A mini descanso

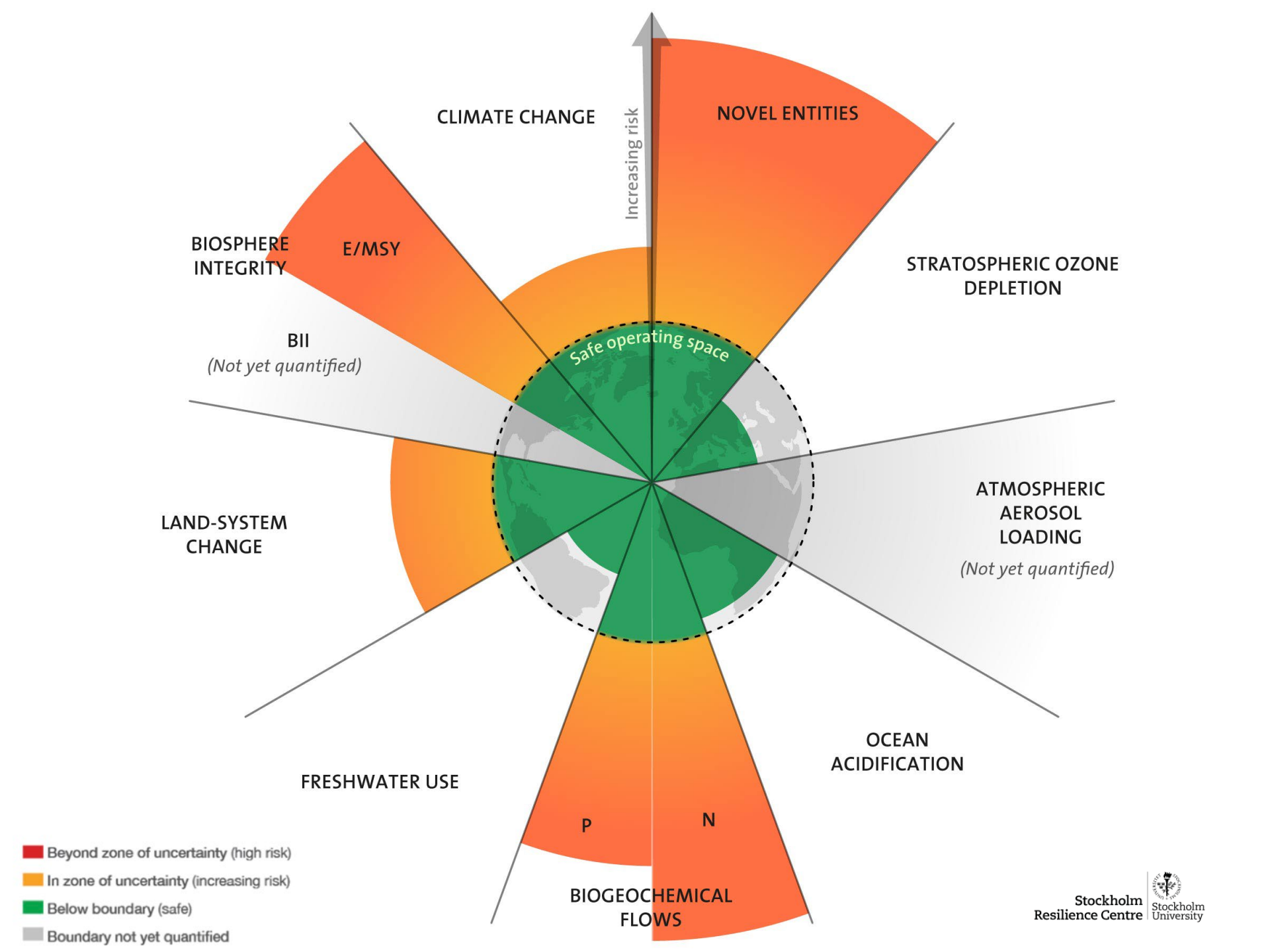
… algo del CONTEXTO DEL SIGLO XXI

La gran aceleración

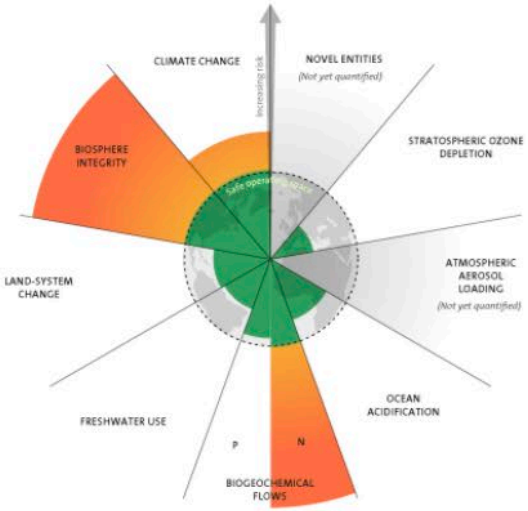


GLOBAL CHANGE
IGBP International Geosphere-Biosphere Programme

Socio-economic trends
Earth system trends

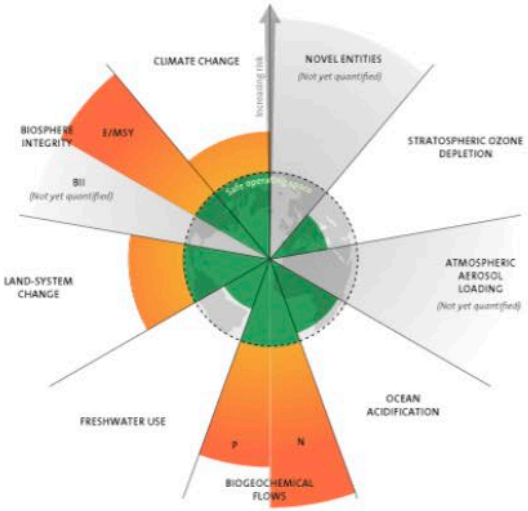

CLIMATE CHANGE
Increasing risk
NOVEL ENTITIES
BIOSPHERE INTEGRITY
E/MSY
BII
(Not yet quantified)
STRATOSPHERIC OZONE DEPLETION
Safe operating space
LAND-SYSTEM CHANGE
ATMOSPHERIC AEROSOL LOADING
(Not yet quantified)
FRESHWATER USE
OCEAN ACIDIFICATION
P
N
BIOGEOCHEMICAL FLOWS
Beyond zone of uncertainty (high risk)
In zone of uncertainty (increasing risk)
Below boundary (safe)
Boundary not yet quantified
Stockholm Resilience Centre
Stockholm University

2009



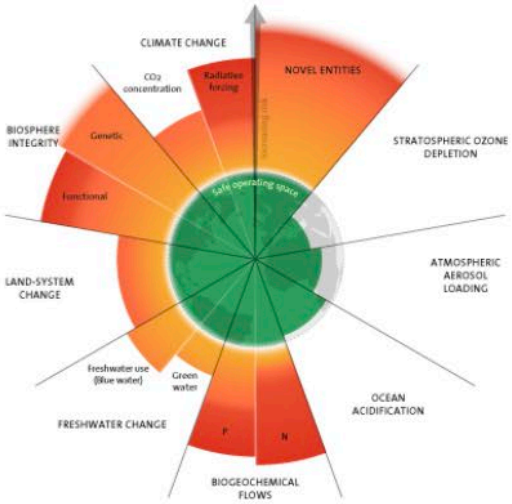
3 boundaries crossed

2015



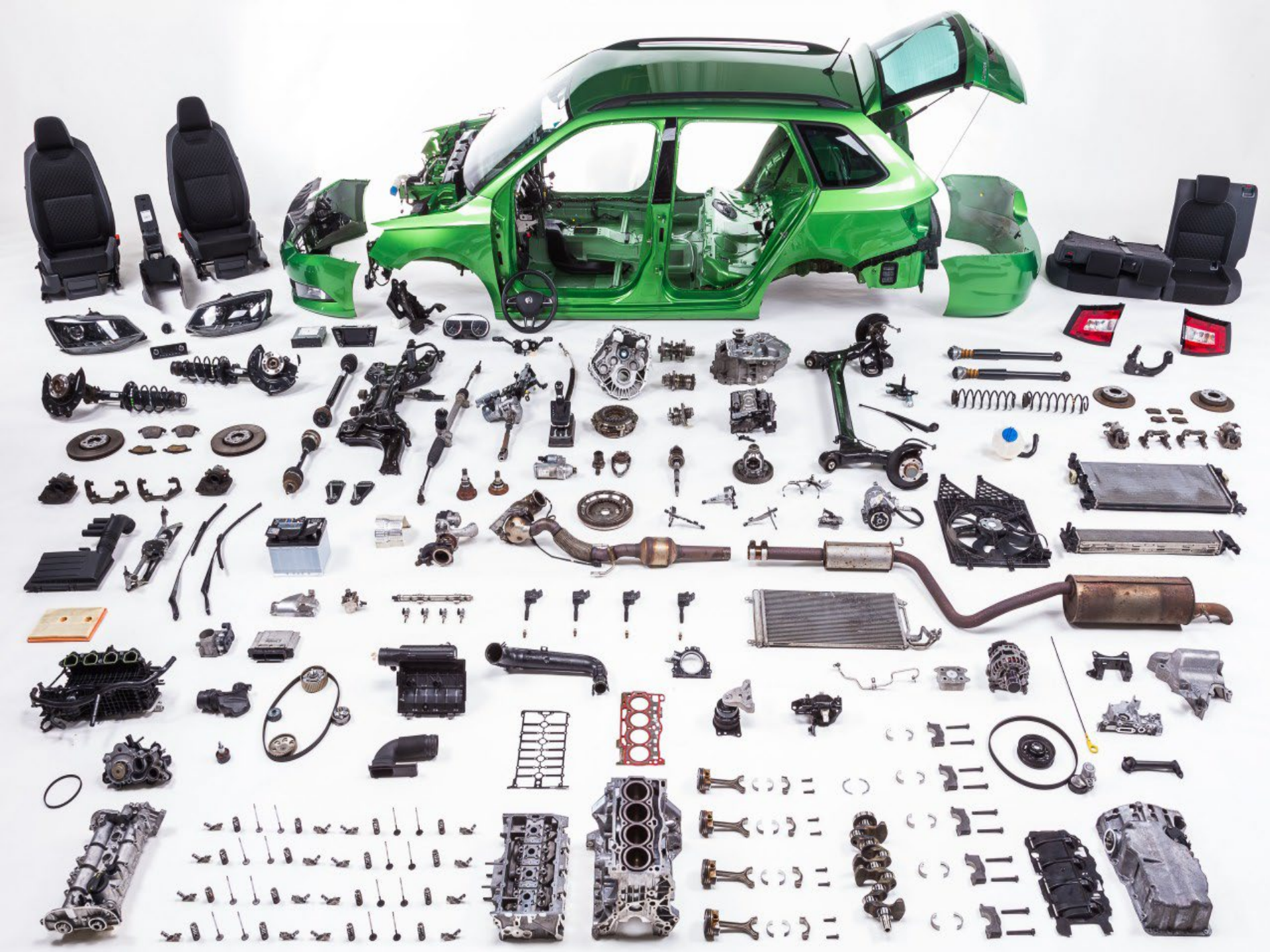
4 boundaries crossed

2023

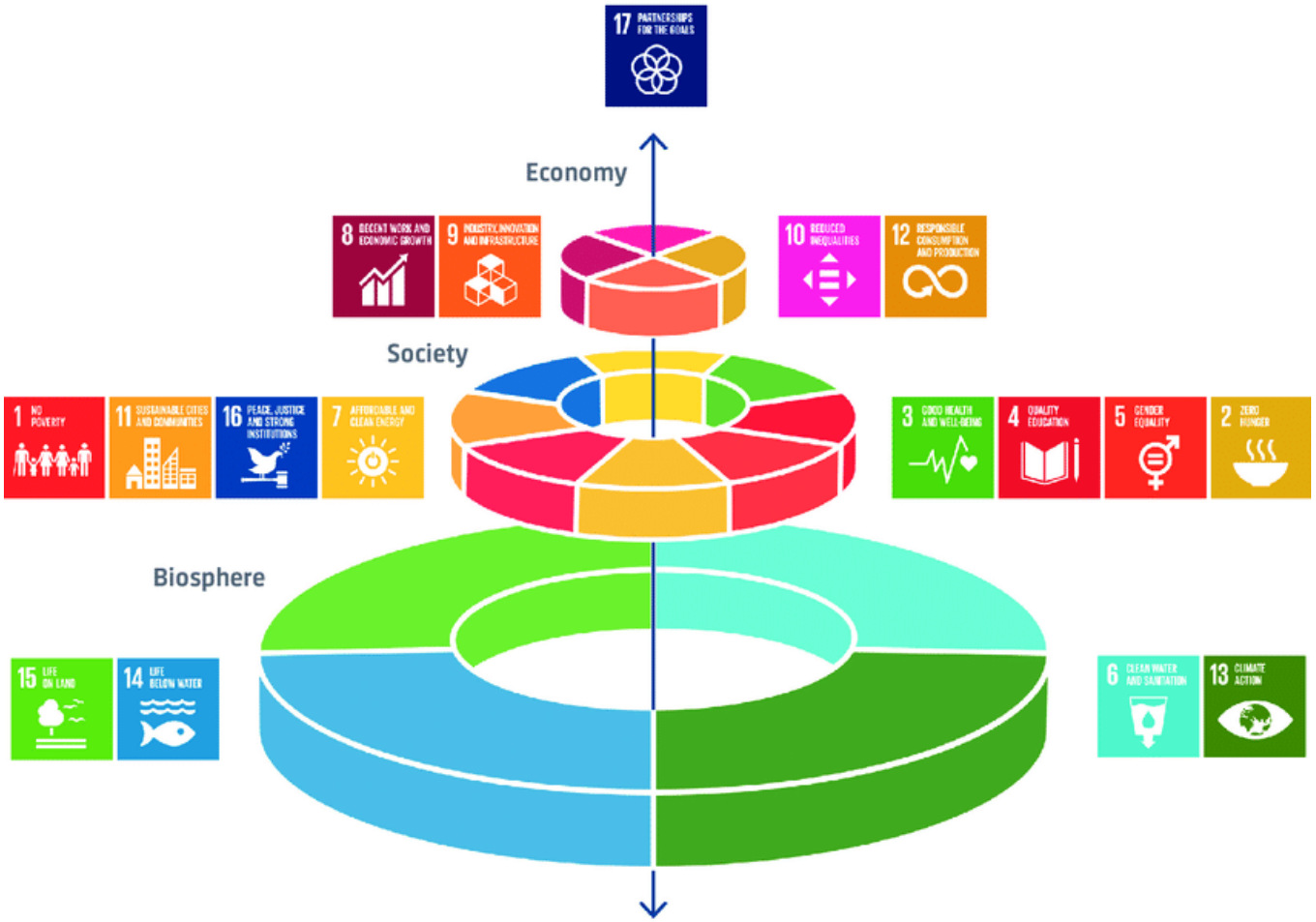


6 boundaries crossed

Science Advances: https://www.science.org/doi/10.1126/sciadv.adh2458

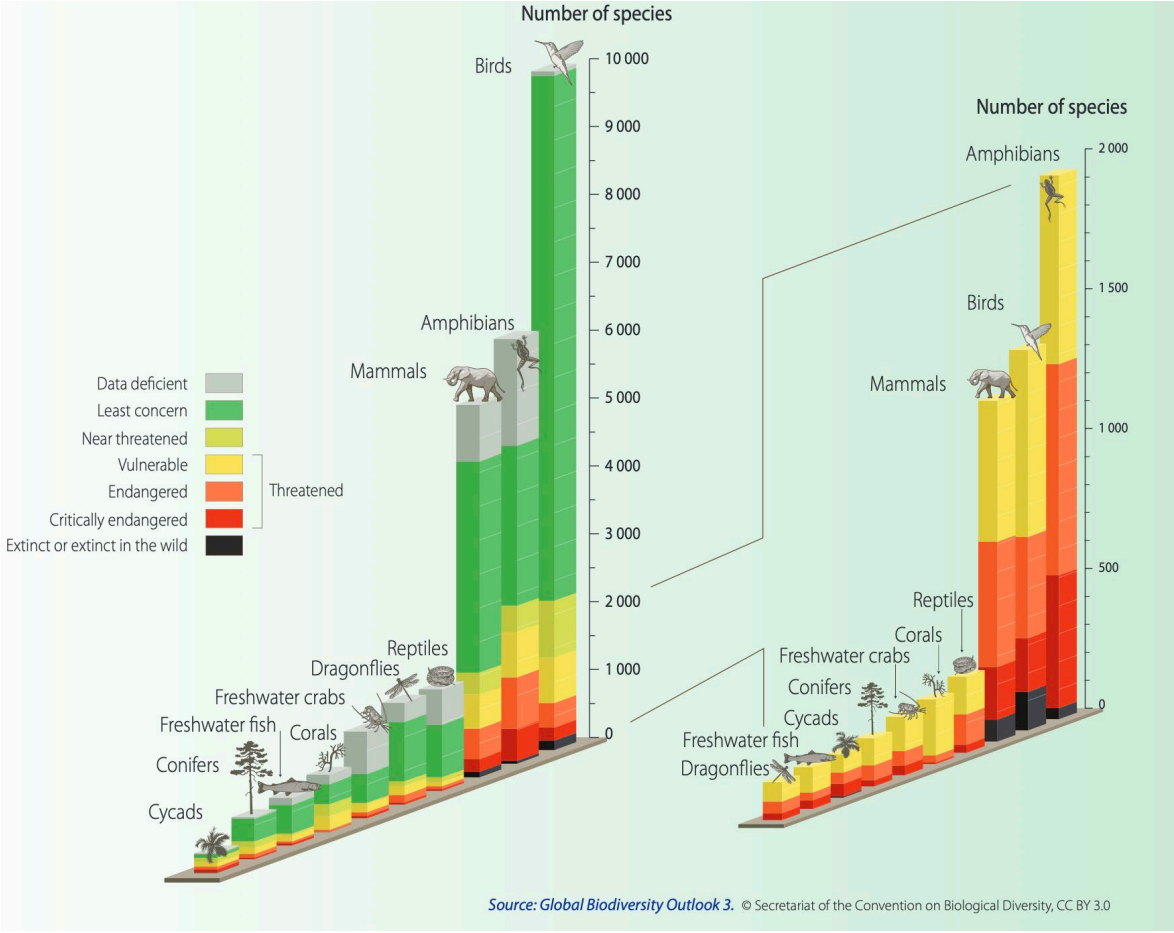


OBJETIVOS DE DESARROLLO SOSTENIBLE


17 PARTNERSHIPS FOR THE GOALS
Economy
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
Society
1 NO POVERTY
11 SUSTAINABLE CITIES AND COMMUNITIES
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
7 AFFORDABLE AND CLEAN ENERGY
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
2 ZERO HUNGER
Biosphere
15 LIFE ON LAND
14 LIFE BELOW WATER
6 CLEAN WATER AND SANITATION
13 CLIMATE ACTION

Las actividades humanas están aumentando el índice de extinción de especies.

El 40% de las especies no están amenazadas



IUCN

Convention on Biological Diversity

Global Risks Report 2023

Top 10 Risks

"Please estimate the likely impact (severity) of the following risks over a 2-year and 10-year period"

Source: World Economic Forum, Global Risks Perception Survey 2022-2023

European Commission

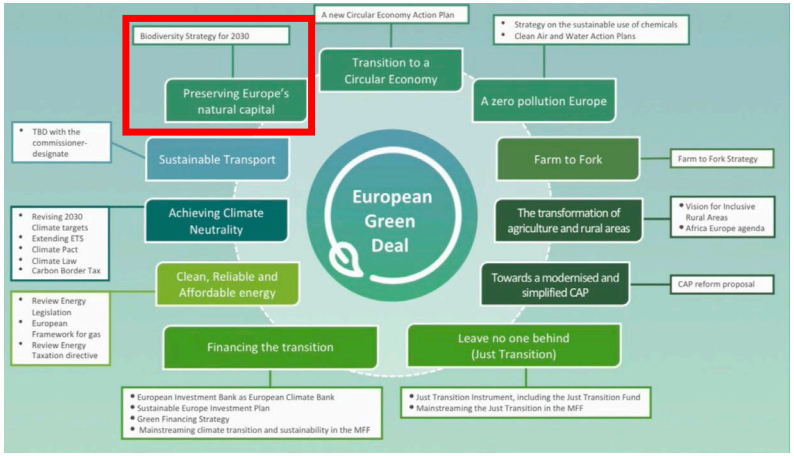
#EUDataCrunch

1 MILLION
species at risk of EXTINCTION

6ª EXTINCIÓN MASIVA DE ESPECIES

Humans have **radically changed** **3/4** of the **Earth's surface**

If we don't change track, all of **humanity will be put at risk**



European Commission

Environment

Home > Nature and biodiversity

- Nature and biodiversity
- Biodiversity Strategy
- Nature and biodiversity law

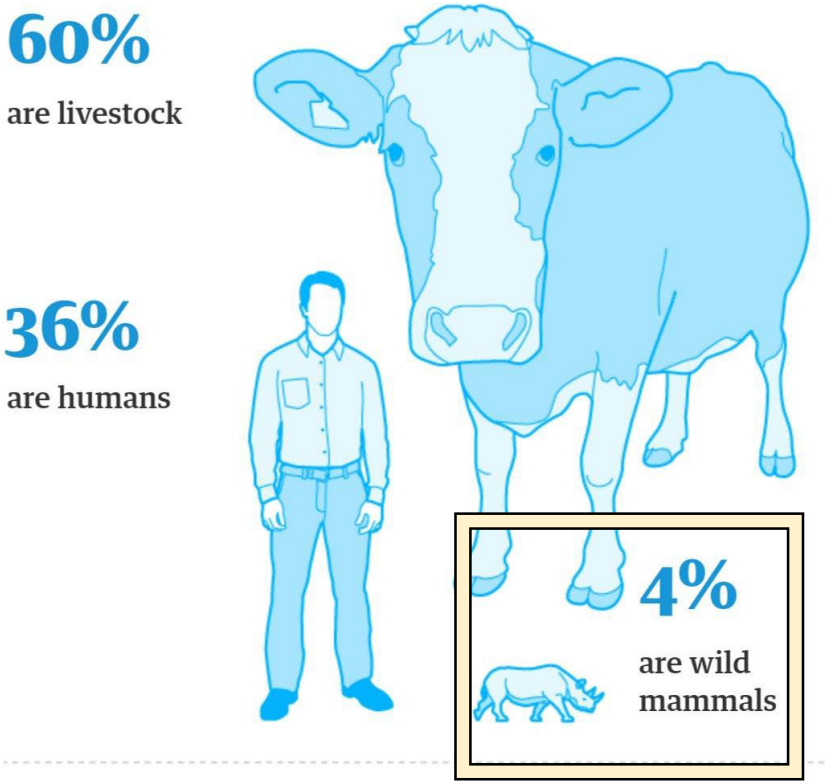
Natural Capital Accounting

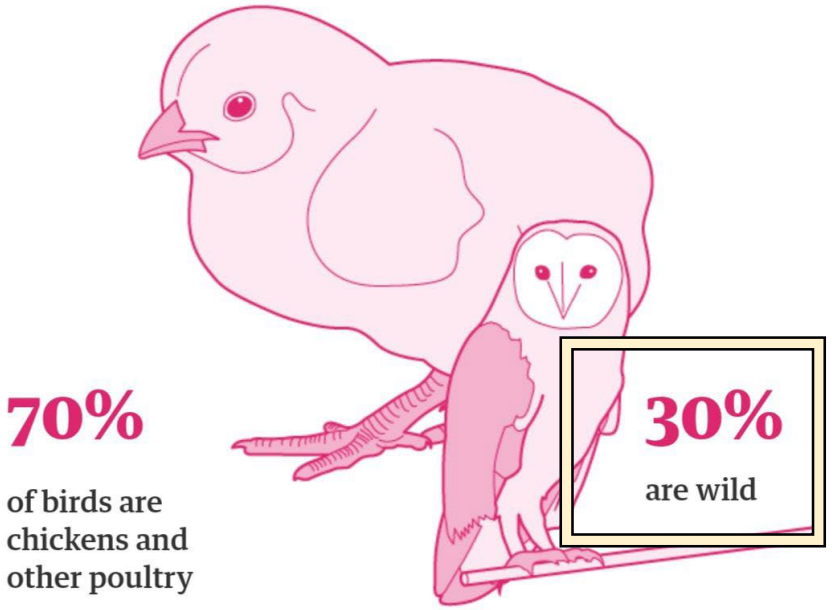
In a nutshell

2022

Newsflash: **Accounting for ecosystems and their services in the European Union**

La Naturaleza es resiliente y diversa pero...





ipbes
Science and Policy for People and Nature

Economies depend on nature

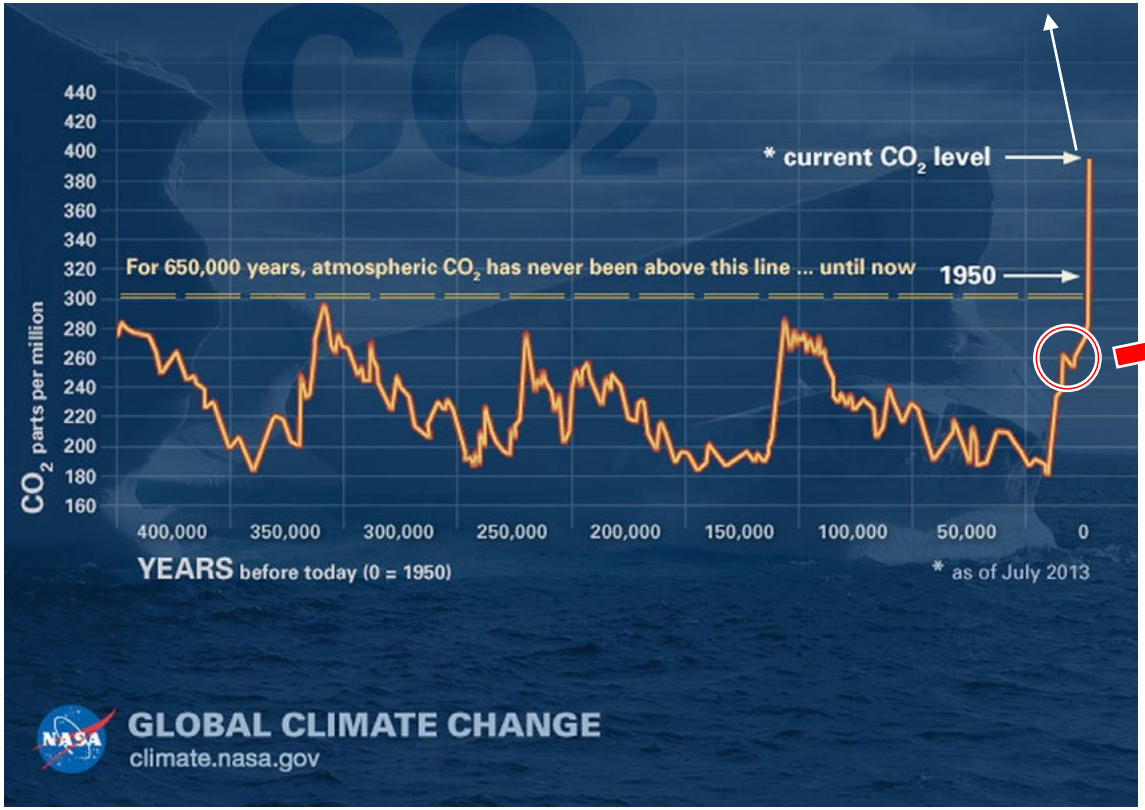
Over half of global GDP is generated by industries dependent on ecosystem services

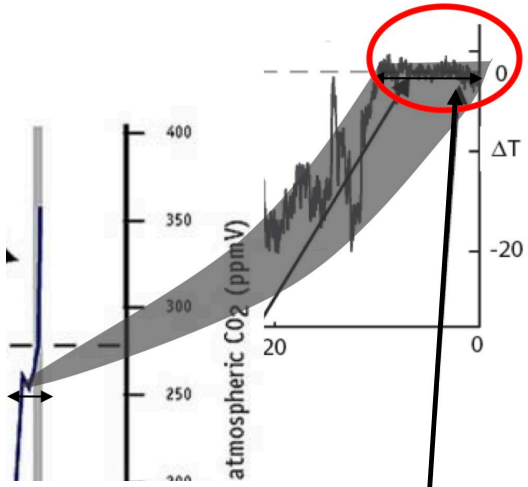
WORLD BANK GROUP

ANTROPOCENO

419

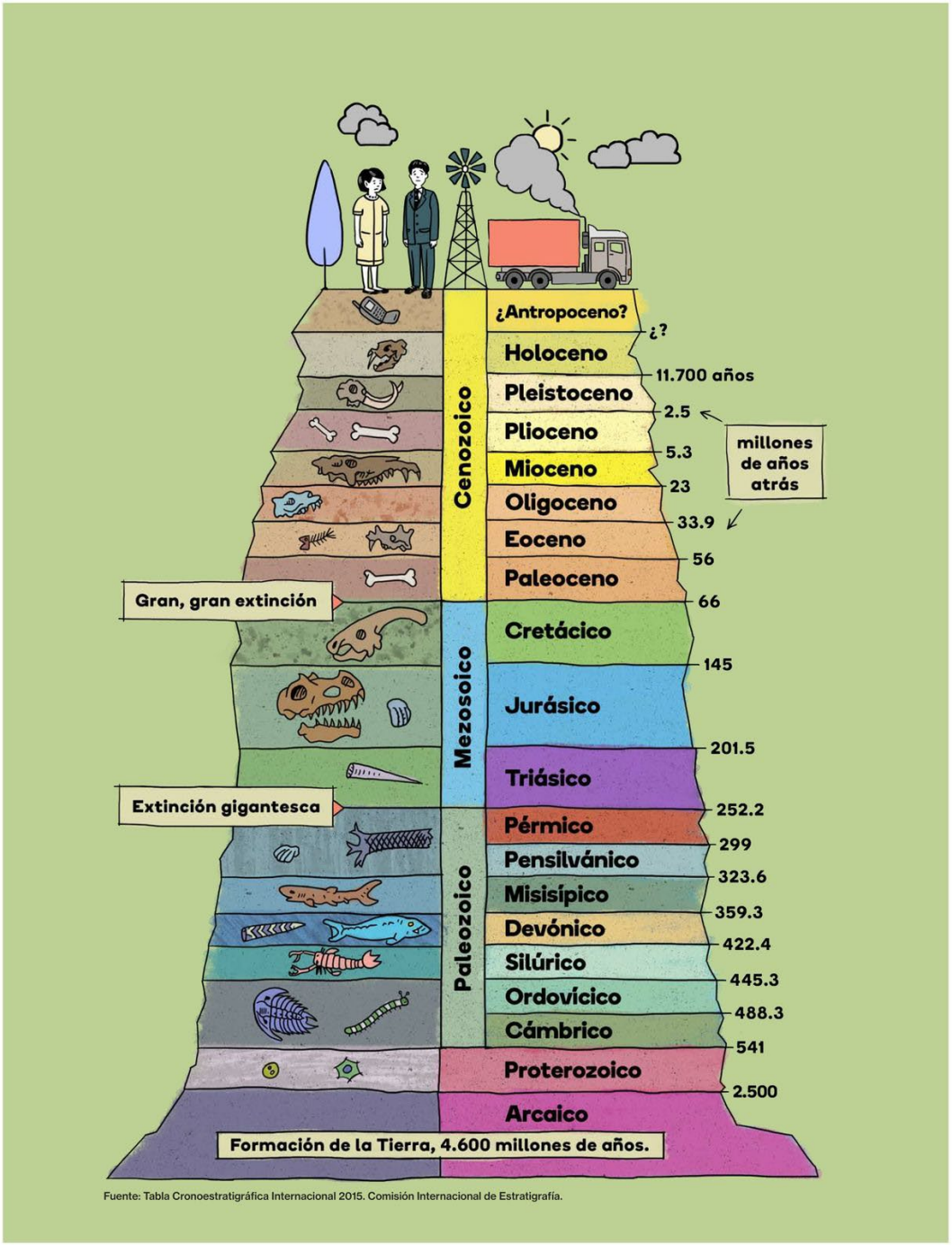
ppm CO_2





HOLOCENO
10.000 años

Estabilidad climática = desarrollo agrícola
Asentamiento de las ciudades
La cultura que conocemos
…

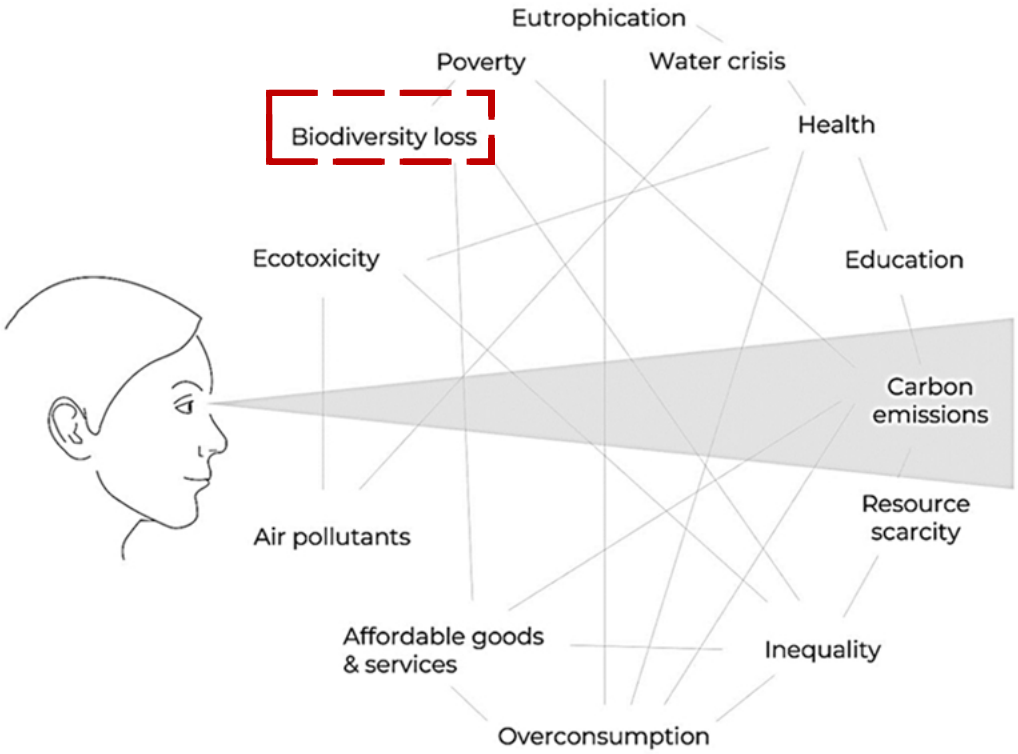


Fuente: Tabla Cronoestratigráfica Internacional 2015. Comisión Internacional de Estratigrafía.

ANTROPOCENO

la especia humana como la mayor fuerza geológica actual

Carbon Tunnel Vision

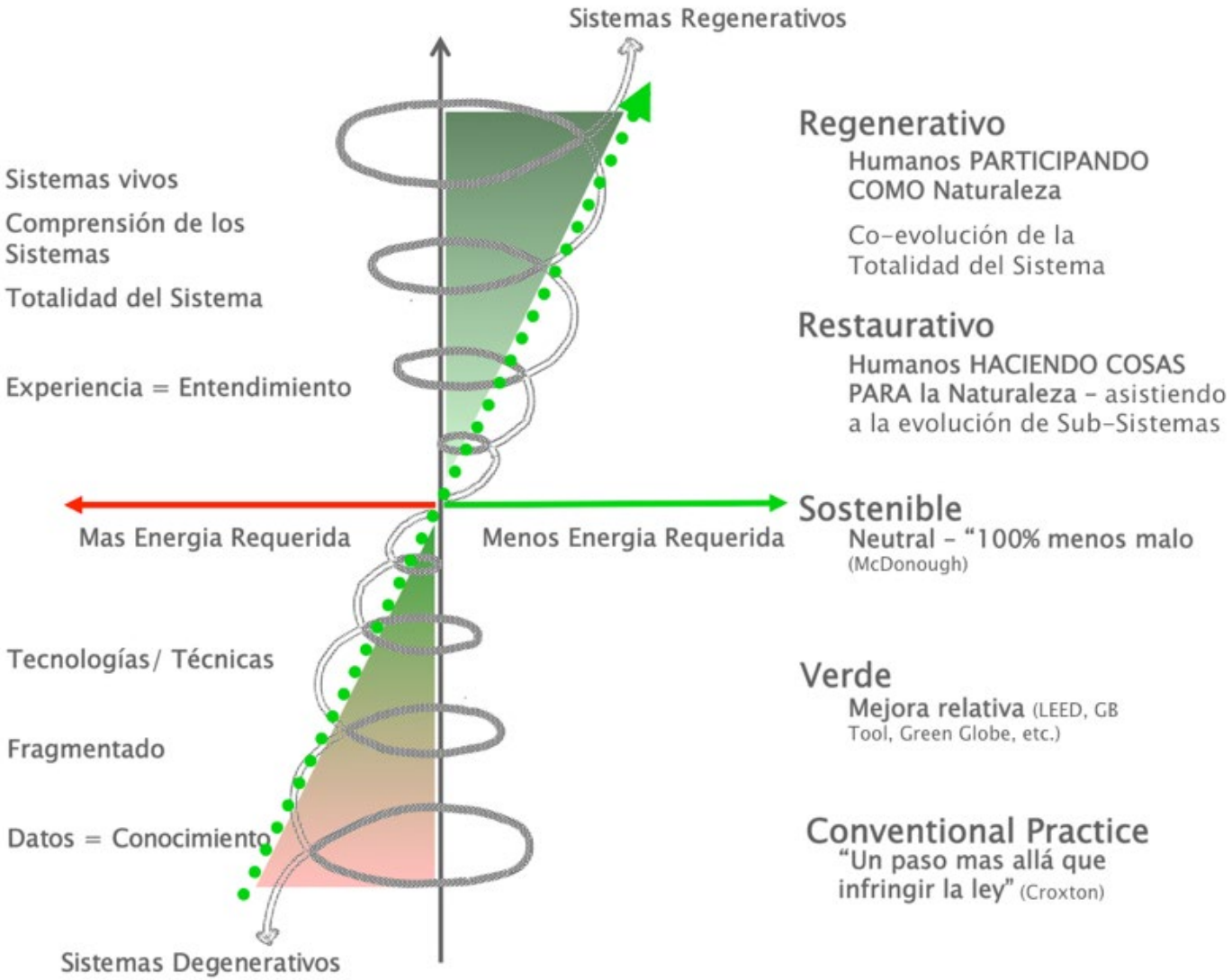


Sustainability transition

Graphic by Jan Konietzko

"monocromo"
cambio climático

"policromo"
+ perdida de biodiversidad


Sistemas Regenerativos
Sistemas vivos
Comprensión de los Sistemas
Totalidad del Sistema
Experiencia = Entendimiento
Mas Energia Requerida
Menos Energia Requerida
Tecnologías/ Técnicas
Fragmentado
Datos = Conocimiento
Sistemas Degenerativos
Regenerativo
Humanos PARTICIPANDO COMO Naturaleza
Co-evolución de la Totalidad del Sistema
Restaurativo
Humanos HACIENDO COSAS PARA la Naturaleza – asistiendo a la evolución de Sub-Sistemas
Sostenible
Neutral – "100% menos malo (McDonough)
Verde
Mejora relativa (LEED, GB Tool, Green Globe, etc.)
Conventional Practice
"Un paso mas allá que infringir la ley" (Croxton)

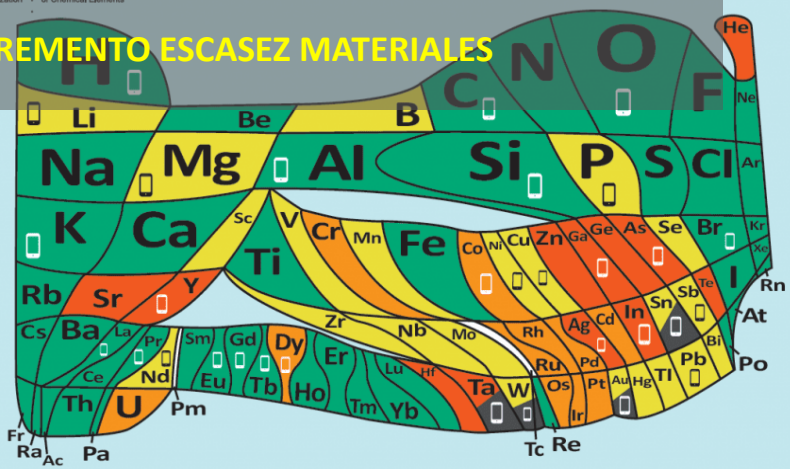
REGENESIS

MAS EVENTOS EXTREMOS (+800 EN 2018)

United Nations Educational, Scientific and Cultural Organization

International Year of the Periodic Table of Chemical Elements

INCREMENTO ESCASEZ MATERIALES



Read more and play the video game **http://bit.ly/euchems-pt**

EuChemS European Chemical Society

Inspired by WF Sheehan's 'A Periodic Table with Emphasis' published in Chemistry, 1976, 49, 17-18'

TIEMPOS DE DESCONTENTOS SOCIALES

CRECIMIENTO DE DESIGUALDADES

42 personas mas ricas del planeta

Ganan = 3.7 billones

6ª EXTINCION MASIVA

ipbes
Science and Policy for People and Nature


Business as usual
is
Not an option

No podemos resolver problemas con la misma manera de pensar que los creó...

BIOMIMESIS

Bio = Vida

Mimesis = emular, transladar *"que no copiar"*

Disciplina y filosofía que aplica las lecciones de la naturaleza para hacer una vida más sana, tecnologías más sostenibles y regenerativas e innovación social de un modo **consciente** (intencional), **emulando** las **mejores estrategias** gracias a las innovaciones de los seres vivos

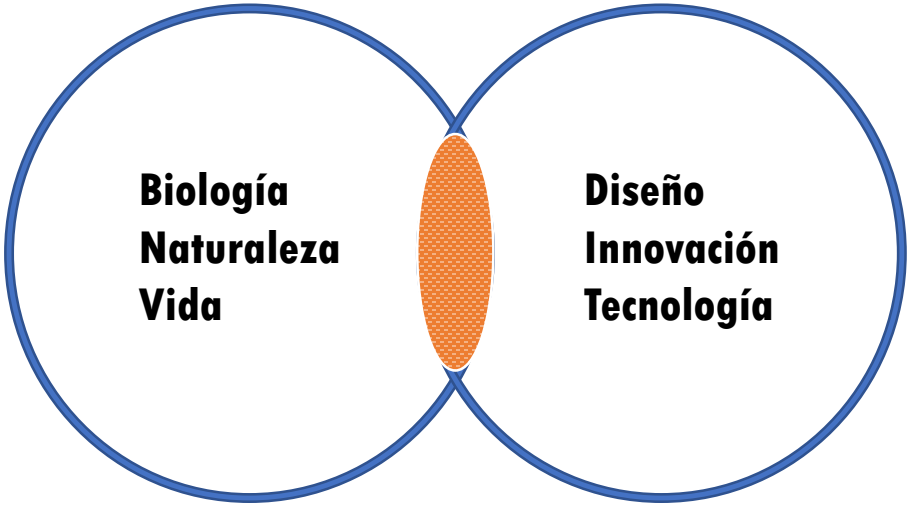
La **Naturaleza** desde la **BIOMIMESIS**

Modelo: La biomimesis es una nueva ciencia que estudia los modelos naturales para emular sus **formas, procesos y sistemas** con el objetivo de resolver problemas humanos de un modo **sostenible y regenerativo**.

Medida: La biomimesis Biomimicry emplea los estándares ecológicos para evaluar la **sostenibilidad** (aspiracional) de nuestras innovaciones. Tras 3,8 billones de evolución, la naturaleza conoce lo que funciona y lo que perdudra.

Mentor: La Biomimesis es una nueva manera de ver y valorar la naturaleza. Introduce una Era basada no en lo que extraemos o domesticamos sino en lo que podemos **aprender** de ella.

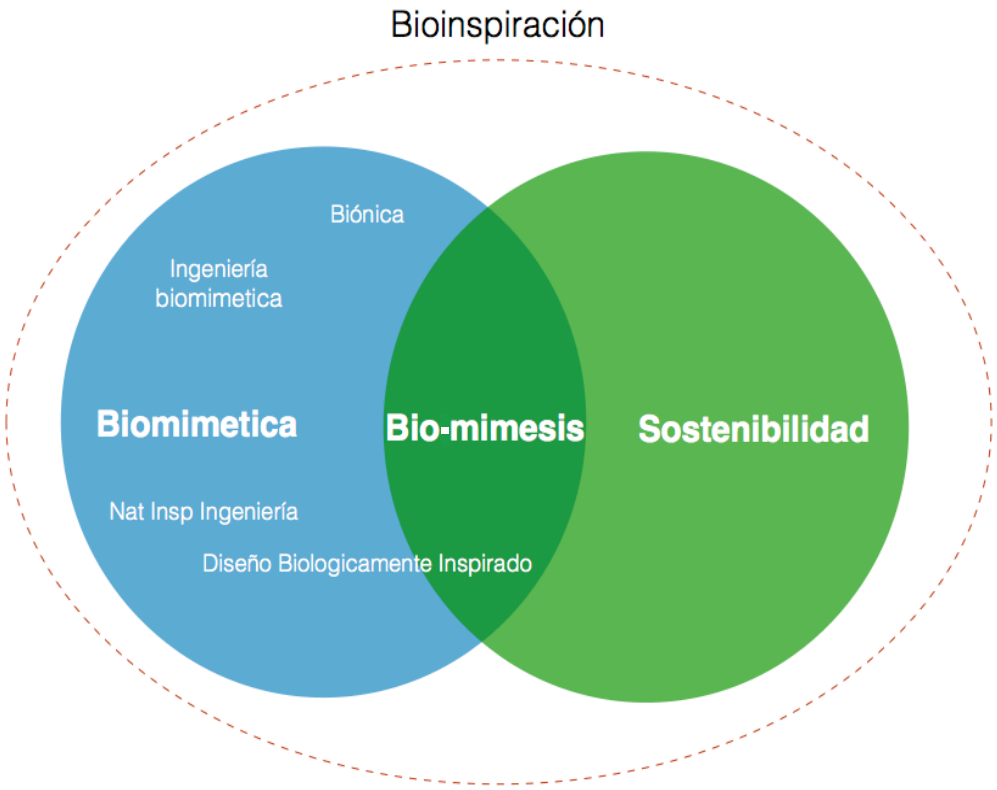
BIOMIMESIS



nature inspire us

BIOMIMESIS

bio vida *mimesis* imitar, emular

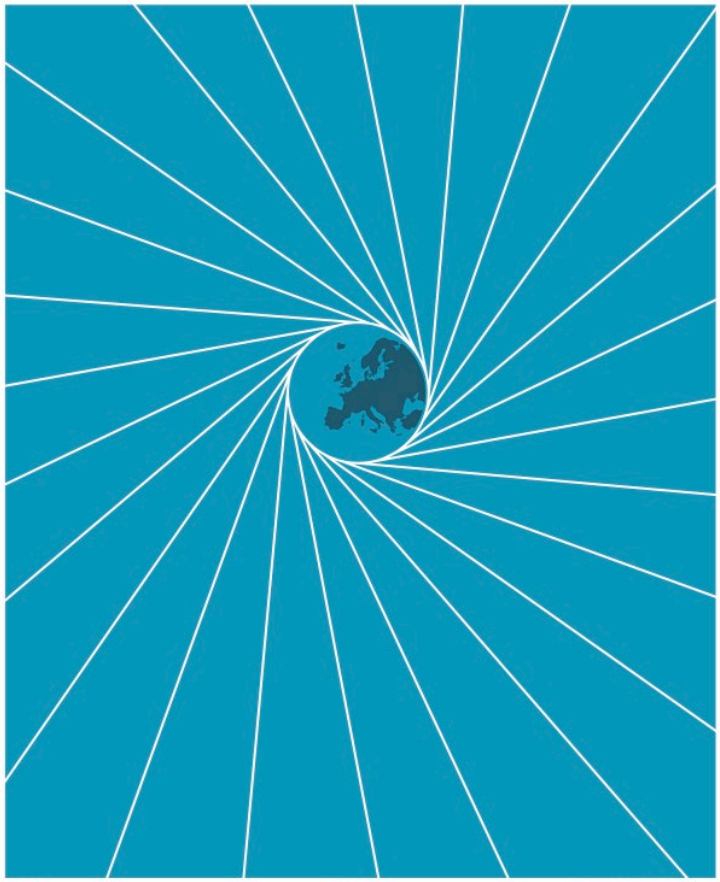


Nature-Based Solutions

This page outline how we can use nature's own resources to tackle environmental challenges

A Research and Innovation policy agenda for Nature-Based Solutions

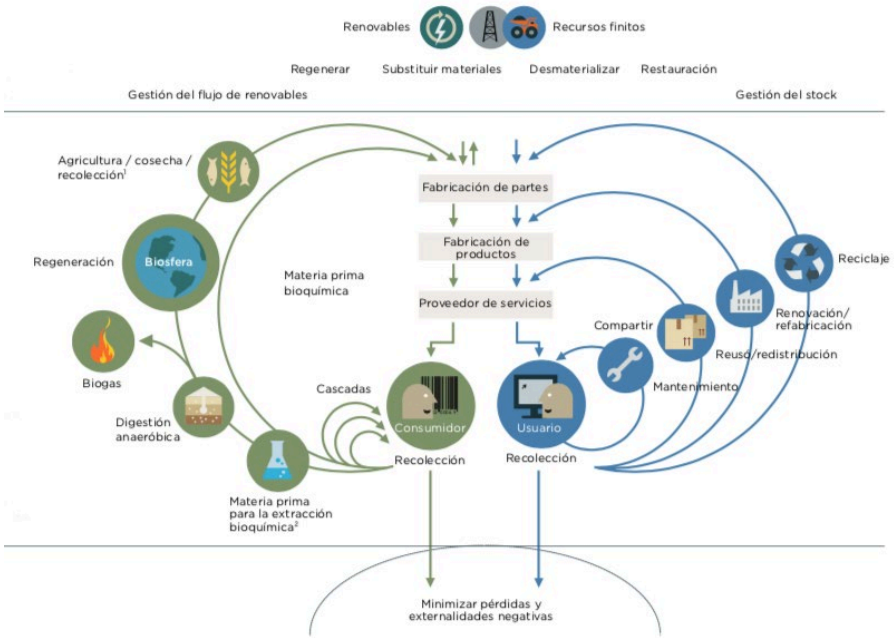
GROWTH WITHIN:
A CIRCULAR ECONOMY VISION FOR A COMPETITIVE EUROPE



ELLEN MACARTHUR FOUNDATION

SUN

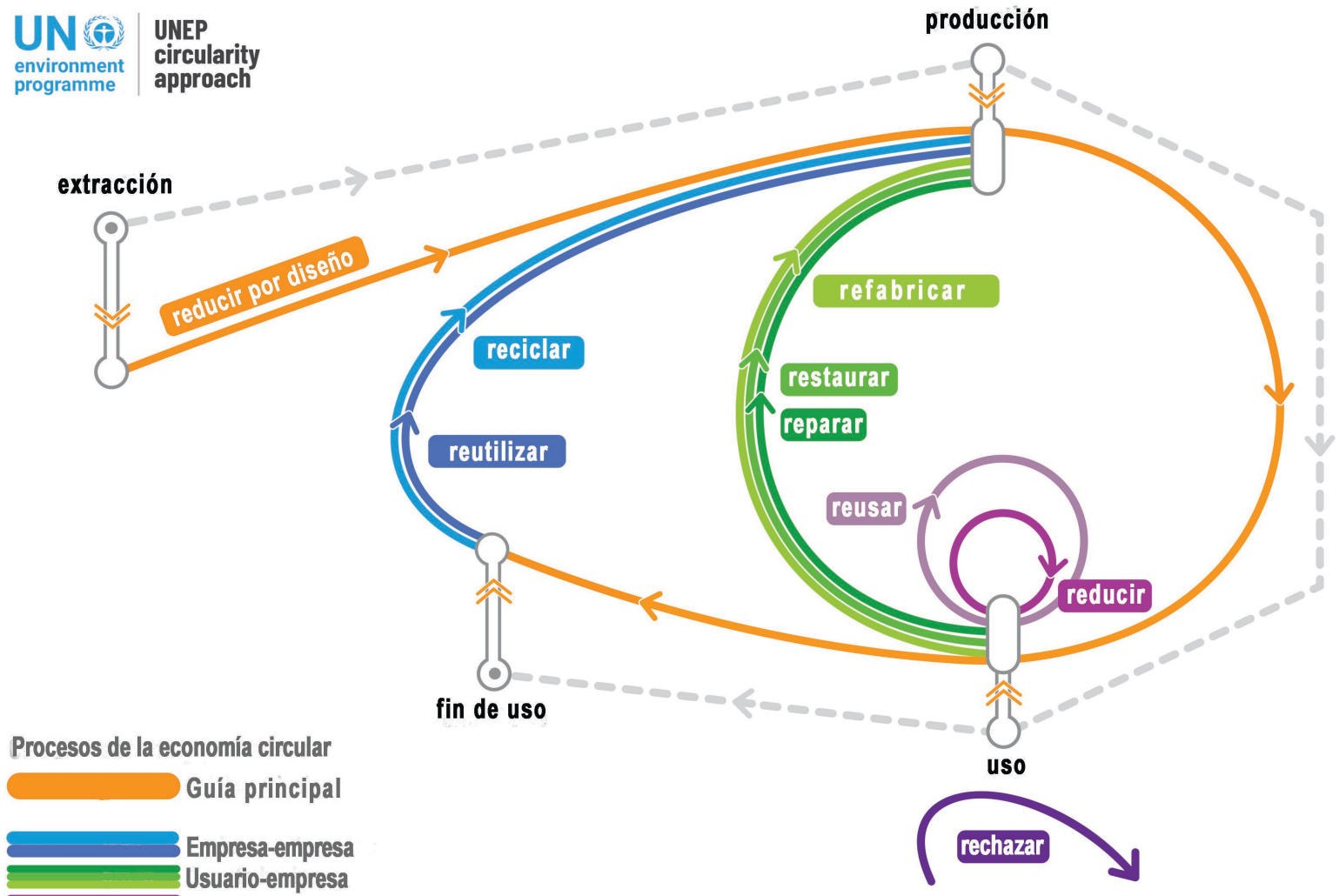
McKinsey Center for Business and Environment



ELLEN MACARTHUR FOUNDATION
Rethink the future

UN environment programme

UNEP circularity approach



Procesos de la economía circular

- Guía principal
- Empresa-empresa
- Usuario-empresa
- Usuario-usuario
- Modelo de economía lineal

United Nations Environment Programme (2019), UNEP circularity platform. **www.unenvironment.org/circularity**

ECONOMIA del donought

https://doughnuteconomics.org/

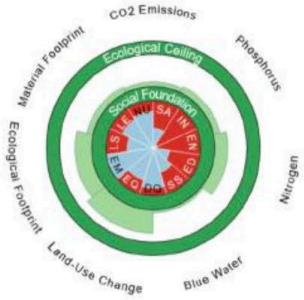
National Doughnuts

A Good Life For All Within Planetary Boundaries

www.goodlife.leeds.ac.uk

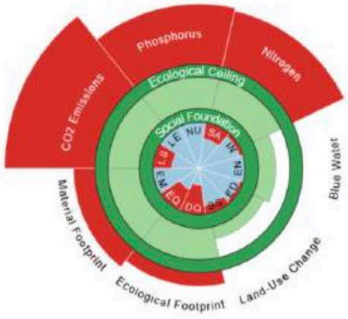
UNIVERSITY OF LEEDS

Malawi



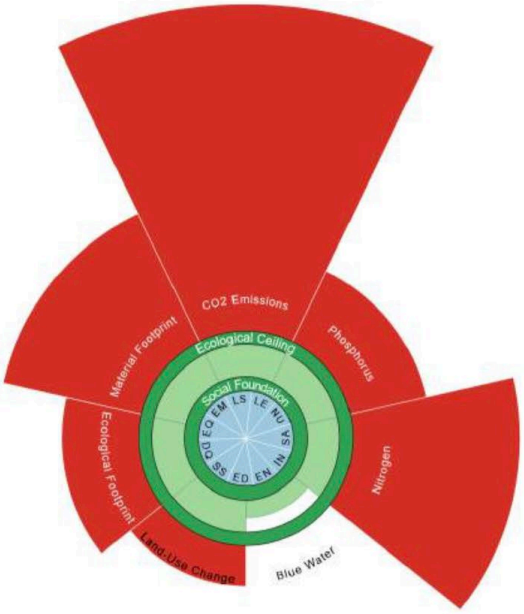
$1,000 pc

China



$17,200pc

Norway



$64,900 pc

V.I.N.E

Virtual Interchange for Nature-Inspired Exploration

Upcoming Events

Biocene 2018
08/14/2018 - 08/17/2018

Social Media

- NASA
- Great Lakes Biomimicry
- Zygote Quarterly
- NASA Glenn GVIS Lab
- N.I.E.A
- CMNH

Education Solicitations and Funding Opportunities

NASA Fellowship Activity 2018: Deadline extended: Friday, March 23, 2018, at 5:50 pm EST

NASA Research Announcement (NRA) NNH18ZHA003N: NASA Fellowship Activity 2018 is seeking

For Researchers

- ABC's "Aerospace, Biomimicry and Other Cool Things
- Biomimicry Timeline
- Nature-Inspired Design and Engineering (NIDE): A New Tool for the Next Generation of Robotic and Human Space Missions
- ROSES-18 Amendment 3: EW

Research Solicitations and Funding Opportunities

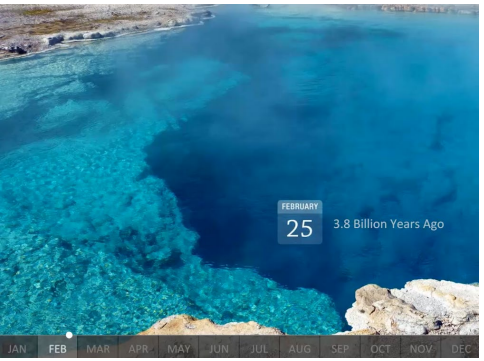
- SBIR/STTR - Research opportunities to participate in research and development efforts in key technology areas. To learn more about bio-inspired opportunities, download this PDF.
- INSPIRES - Search for other

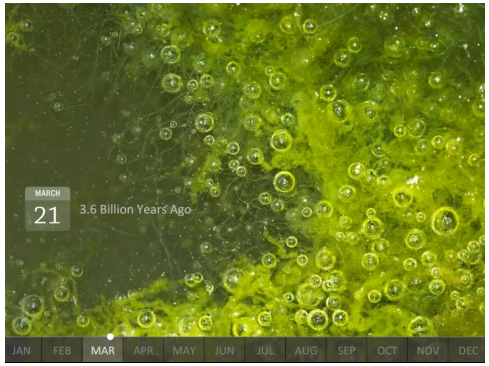
De donde viene la innovación?

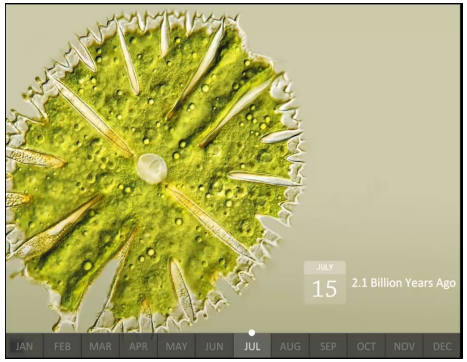
el proceso mas antiguo del planeta


4. 500 millones de años
Edad de la Tierra comprimida en 1 año
144 años = 1 segundo

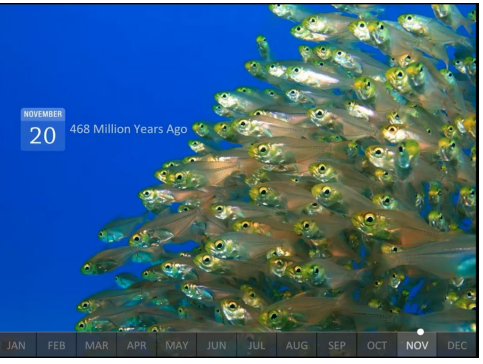

JANUARY
1
00:00:01
4.54 Billion Years Ago

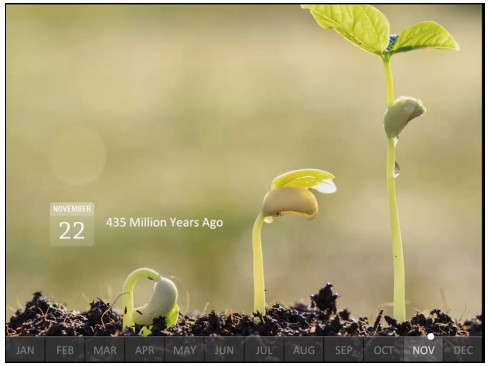

FEBRUARY
25
3.8 Billion Years Ago
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

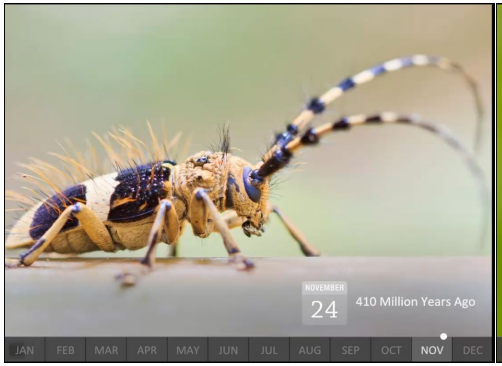

MARCH
21
3.6 Billion Years Ago
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

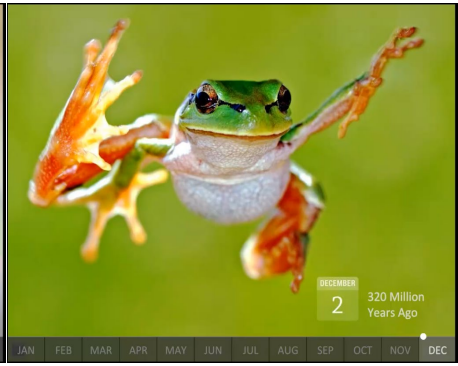

JULY
15
2.1 Billion Years Ago
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

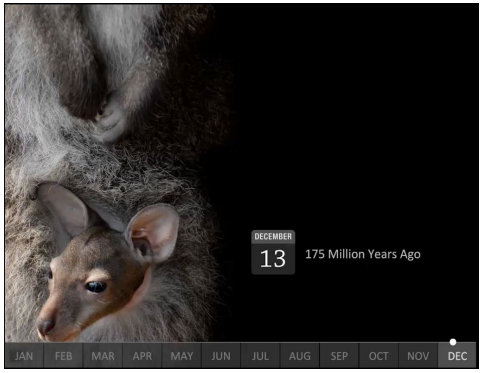

SEPTEMBER
17
1.3 Billion Years Ago
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


NOVEMBER
20
468 Million Years Ago
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


NOVEMBER
22
435 Million Years Ago
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

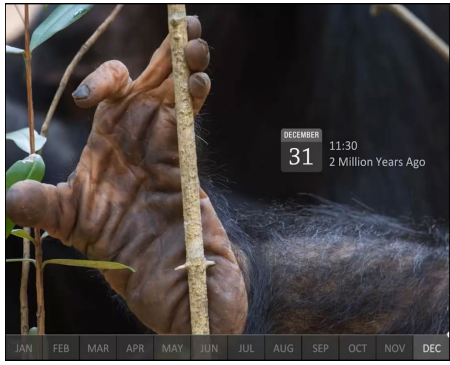

NOVEMBER
24
410 Million Years Ago
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

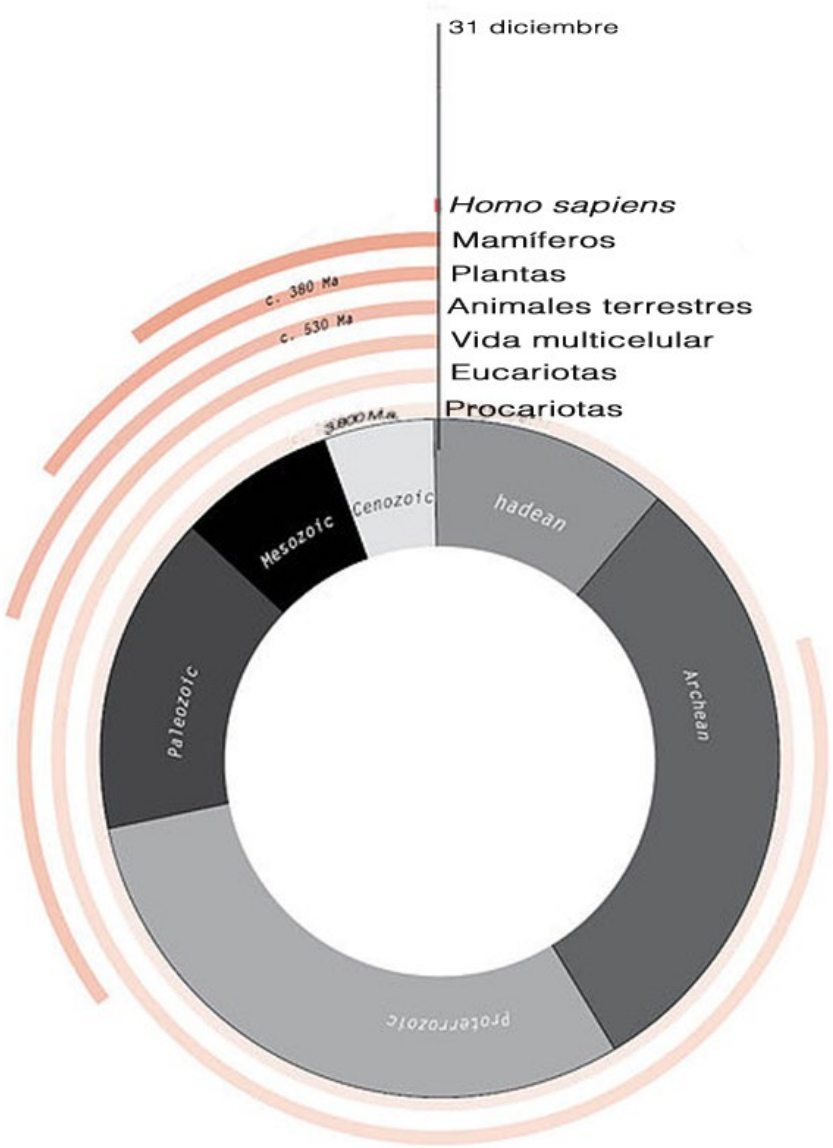

DECEMBER
2
320 Million Years Ago
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


DECEMBER
13
175 Million Years Ago
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


DECEMBER
18
115 Million Years Ago
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


DECEMBER
25
18:30
65 Million Years Ago
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


DECEMBER
31
11:30
2 Million Years Ago
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


31 diciembre
Homo sapiens
Mamíferos
Plantas
Animales terrestres
Vida multicelular
Eucariotas
Procariotas
c. 380 Ma
c. 530 Ma
3.800 M.a.
Cenozoic
Mesozoic
Paleozoic
hadean
Archean
proterrozoic


DECEMBER
31
23:36
200,000 Years Ago


DECEMBER
31
23:59:00
10,000 Years Ago
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC

6 minutos

BIOMIMESIS

0,004 *H.sapiens* especie muy joven

1,5 millones de especies (conocidas)

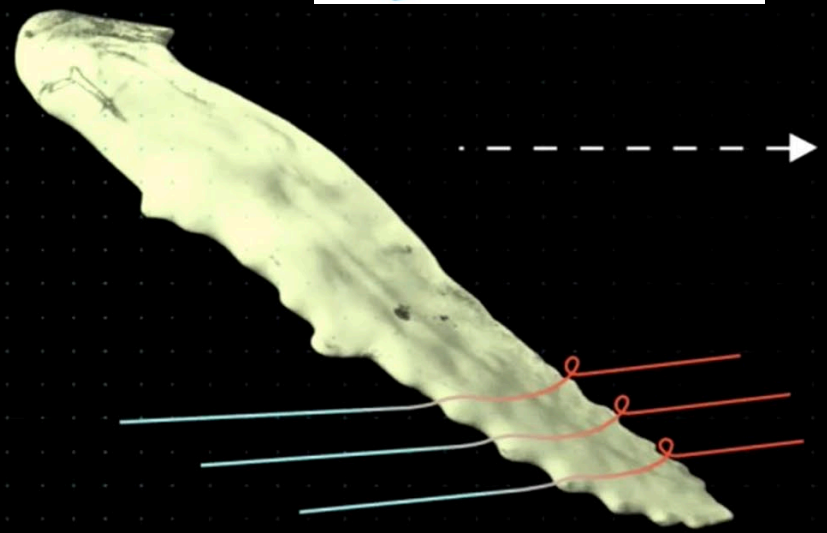
3,8 billones de años experiencia testada

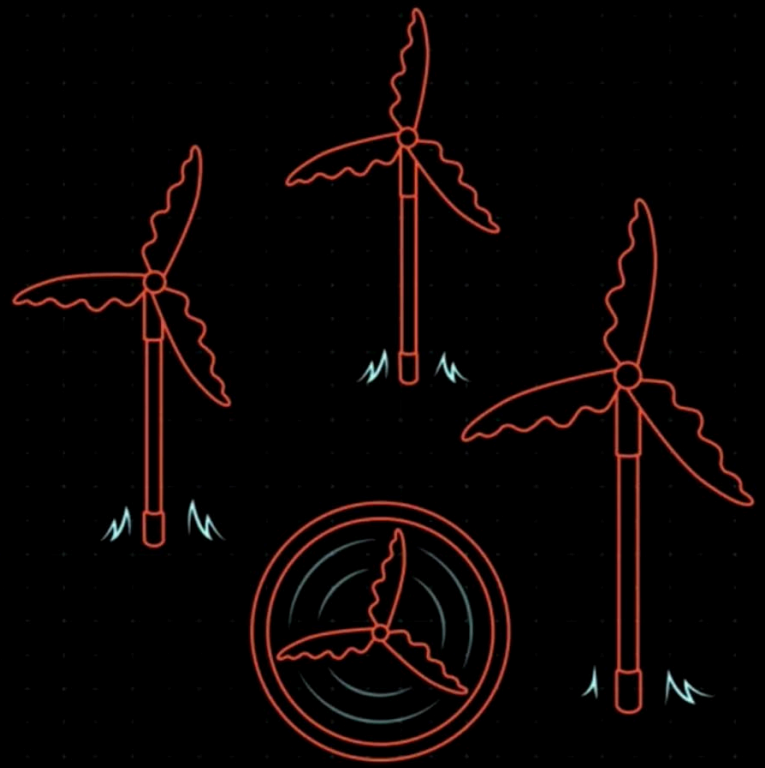
12% soluciones humanas compartidas

WHALEPOWER

BUILDING THE ENERGY FUTURE

ON A MILLION YEARS OF FIELD TESTS



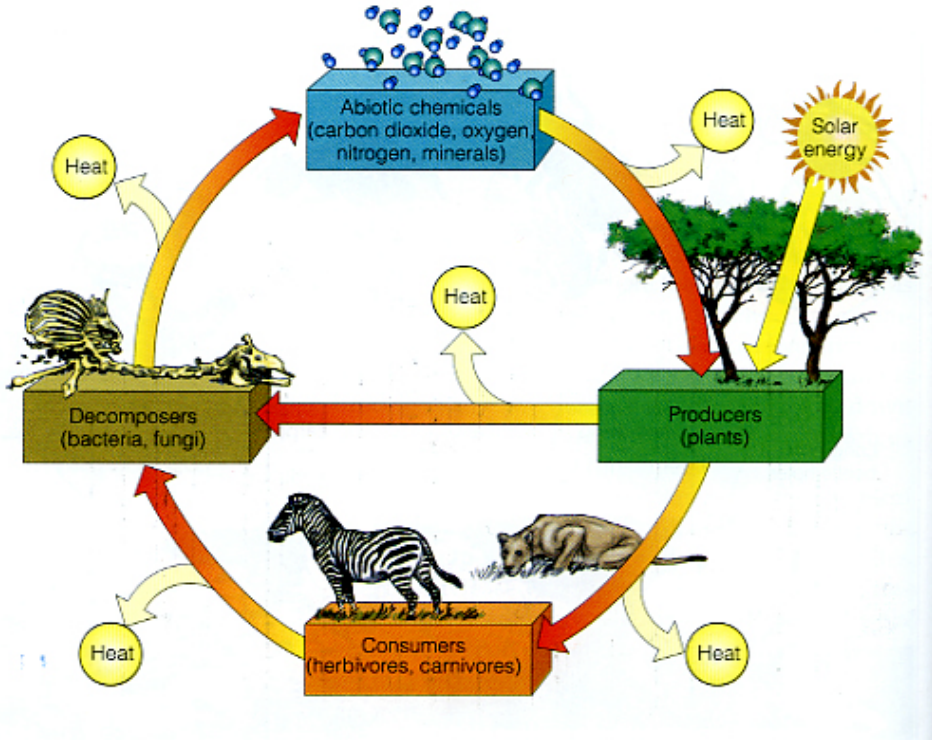


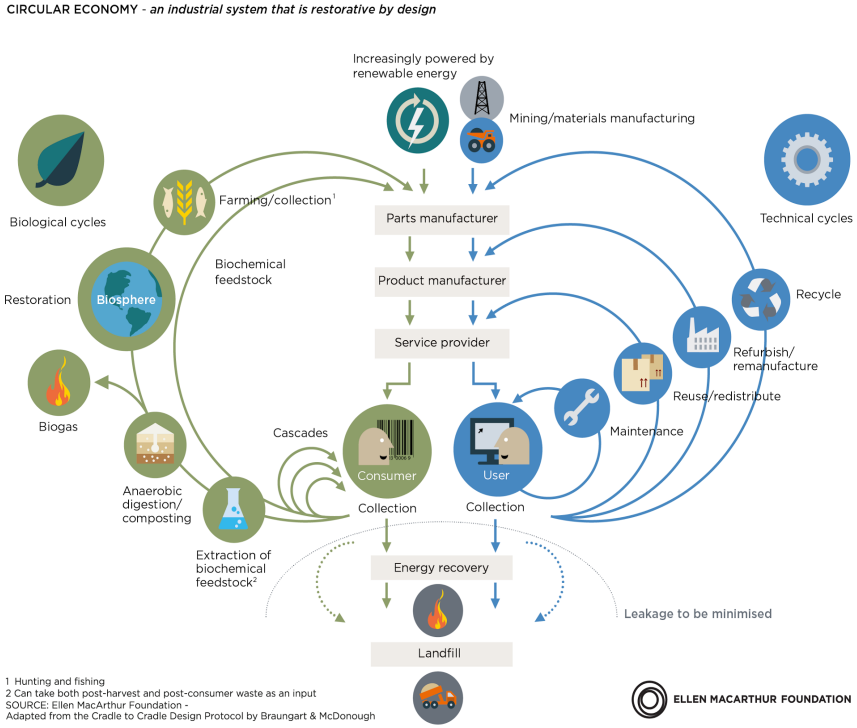
NIVELES

Problema de Diseño

5 polímeros para fabricar esto….

350 polímeros para hacer esto…

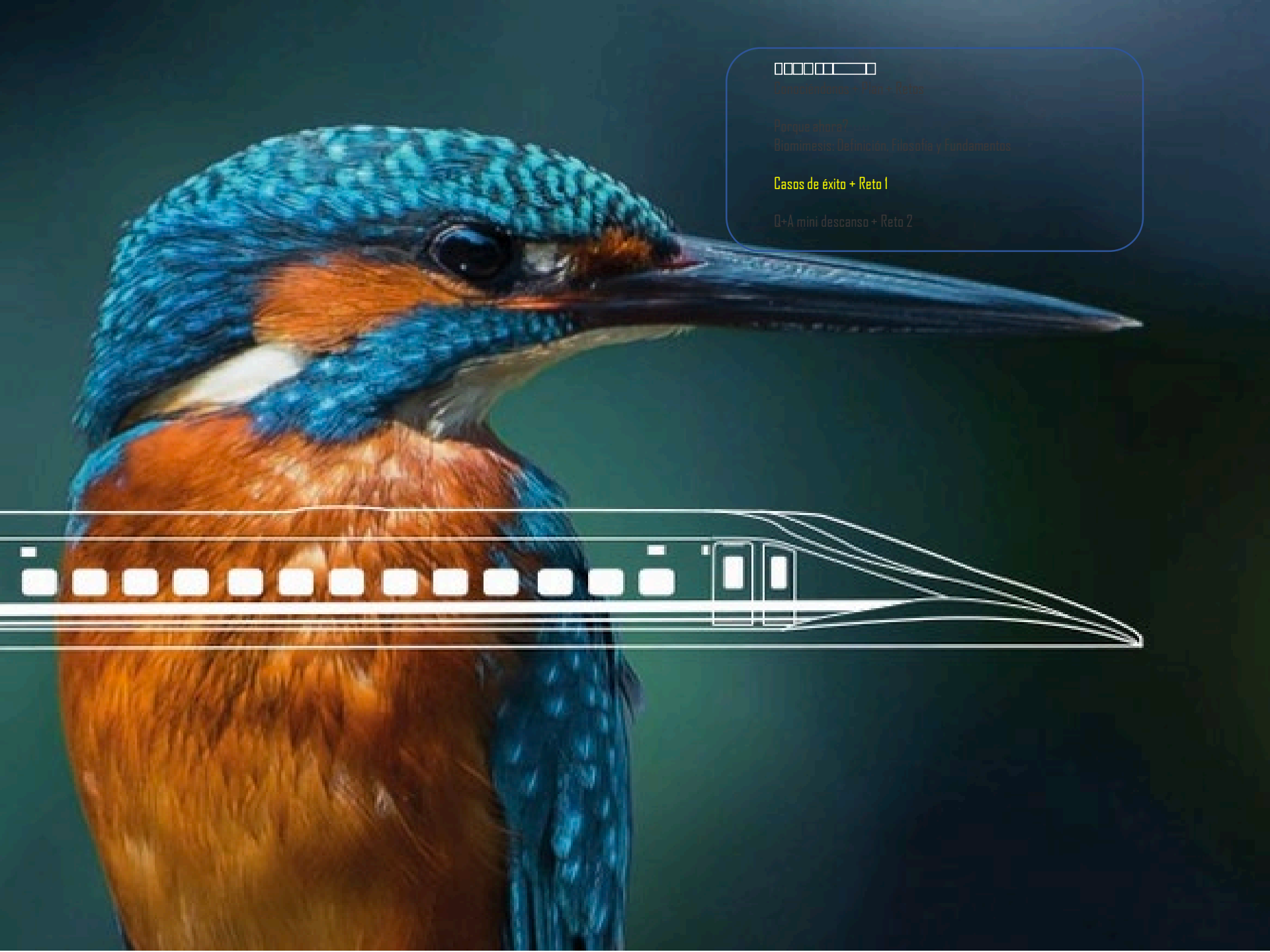




Estrategia Naturaleza

Estrategia Humana

nature inspire us



Conocendonos + Plan + Retos

Porque ahora?

Biomimesis: Definicion, Filosofia y Fundamentos

Casos de éxito + Reto 1

Q+A mini descanso + Reto 2

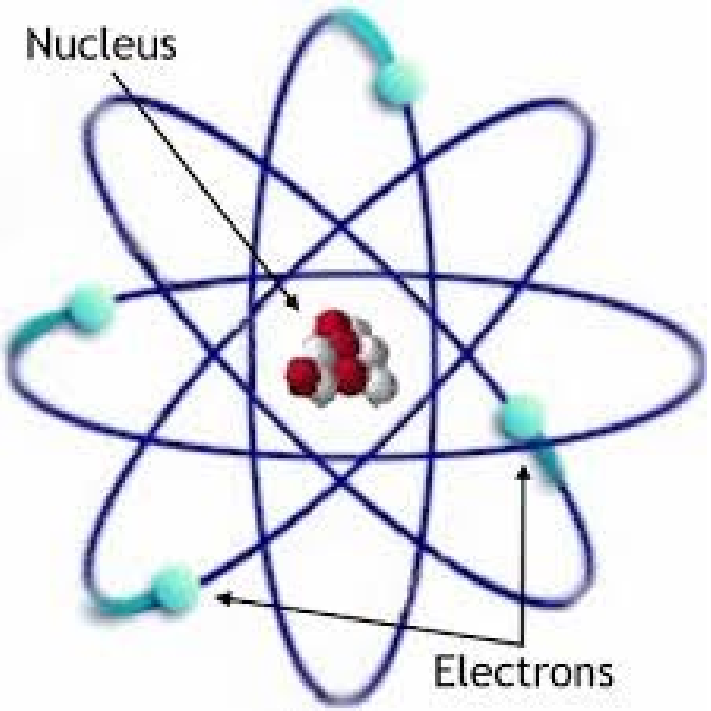
Diseño por analogías en biomimesis

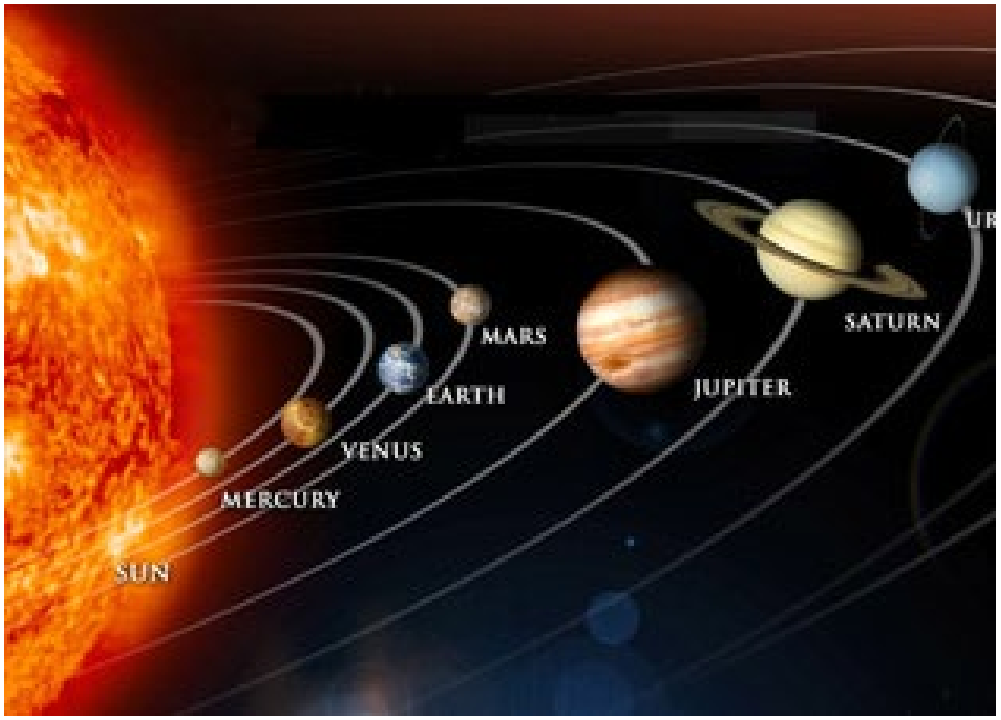
1· **Analogía:** similitud en algunos aspectos entre cosas que de otro modo son diferentes; una comparación entre dos cosas, generalmente con el propósito de explicar o aclarar.

2· **Las analogías** se pueden utilizar para resolver problemas, reconociendo cuándo el diseño es similar a un problema previamente resuelto.

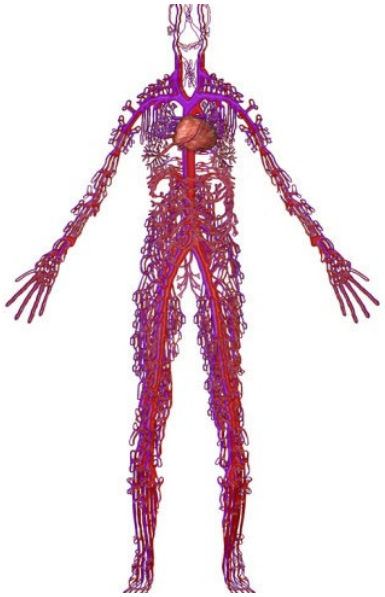
3· Sabemos que las **ideas estimuladas por analogías** de campo lejano (fuera del dominio común) tienen más probabilidades de ser novedosas/innovadoras que otras aproximaciones mas convencionales.

El movimiento de los electrones alrededor del núcleo de un átomo es análogo a la rotación de la Tierra alrededor del sol





Un coágulo de sangre es análogo a un atasco de tráfico e impide que las células sanguíneas realicen sus entregas vitales

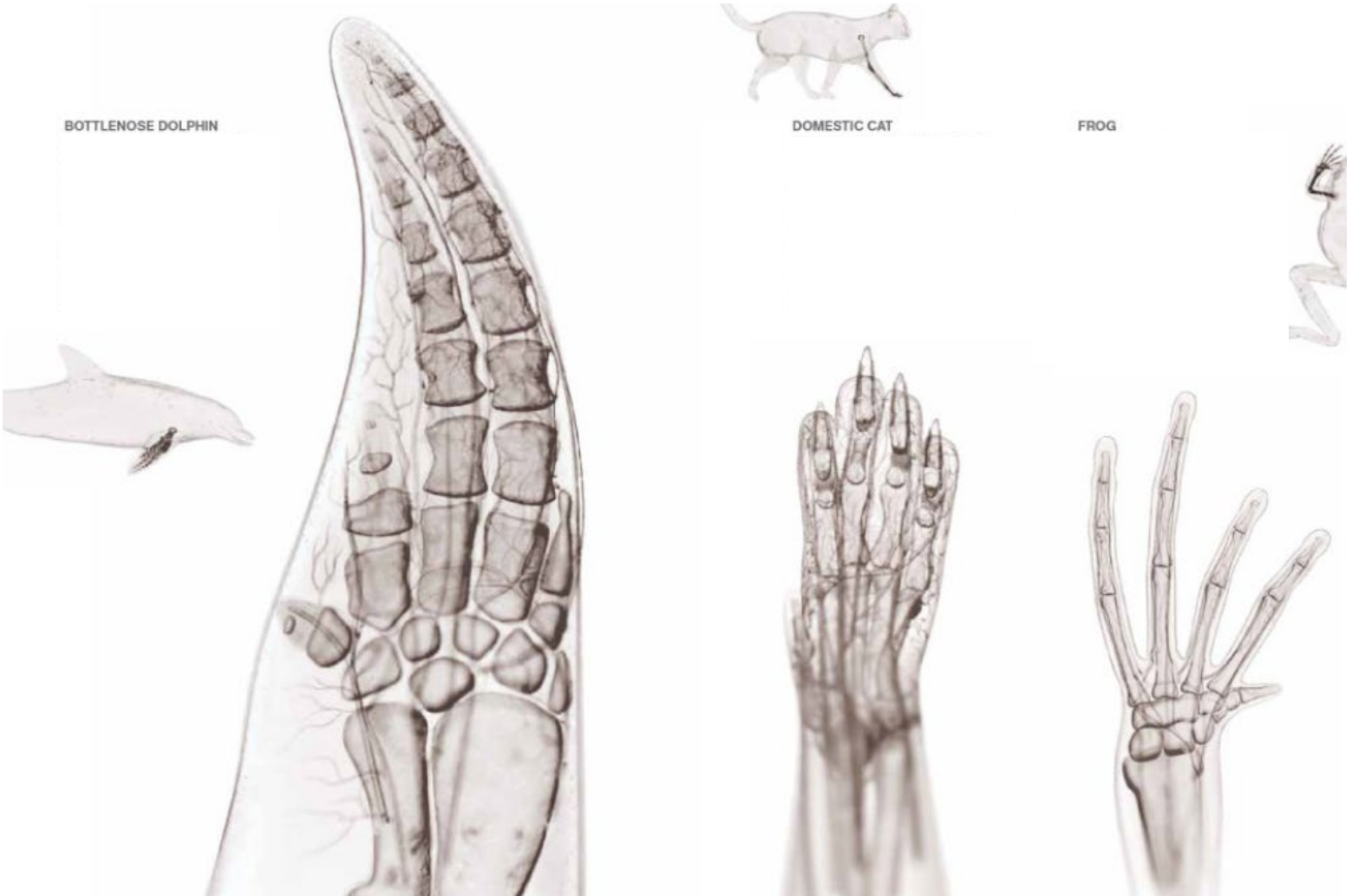


El marco (estructura de sostén) de una bicicleta, es análoga en el funcionamiento al del endoesqueleto de un vertebrado

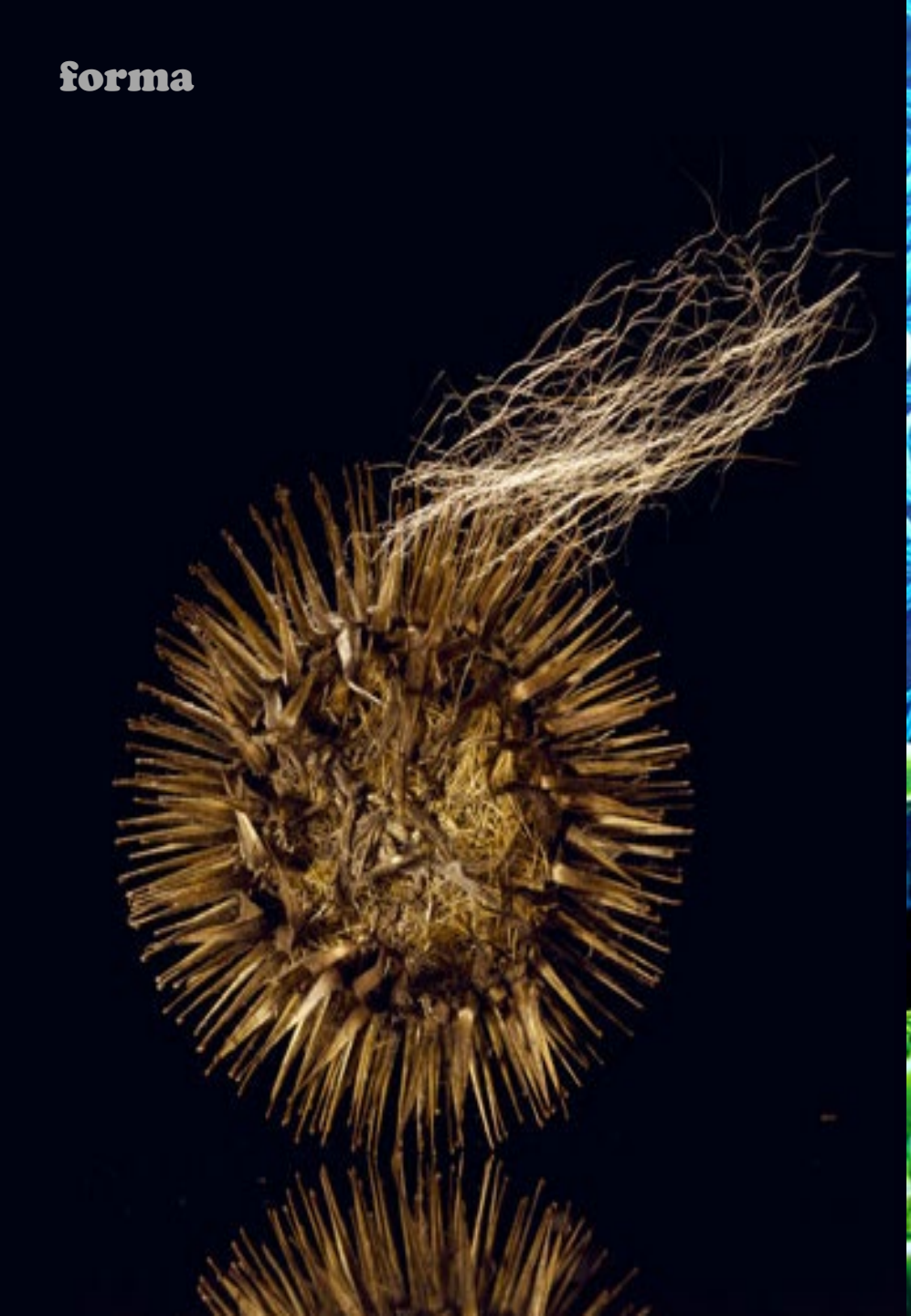
Cual es un análogo natural, al alambre de espino?

La defensa de una propiedad se asemeja a la defensa de muchos organismos vivos

la forma se ajusta a la función



forma



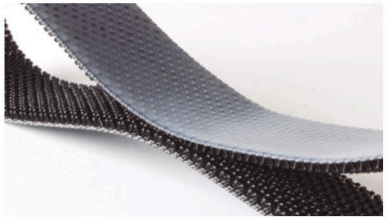
fight against COVID-19.

Learn More

Medical Personal Care Footwear & Apparel Military Consumer

Industrial Transportation Construction Packaging

High Technology Hook Tapes



ALFA-LOK® Hook to Hook Fastener

Nov. 21, 1961 G. DE MESTRAL 3,009,235
SEPARABLE FASTENING DEVICE
Filed May 9, 1958 4 Sheets-Sheet 2

Fig. 1a

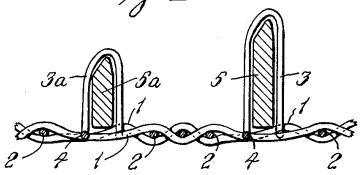


Fig. 2

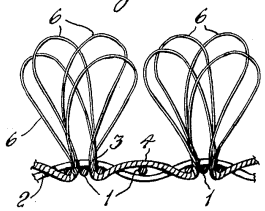
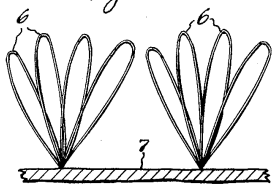


Fig. 3



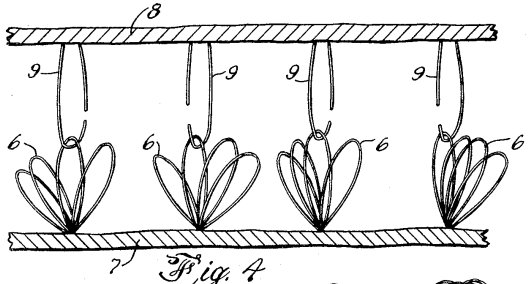


Fig. 4

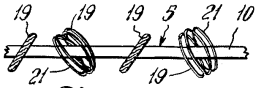


Fig. 10

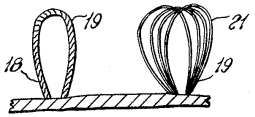
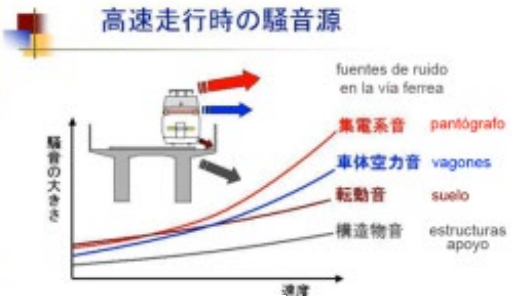


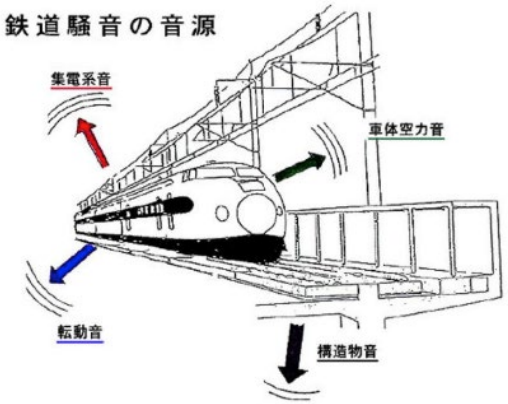
Fig. 11


APOLLO
NASA

De la CURIOSIDAD
al BENEFICIO de la Sociedad i4

niu
nature inspire us



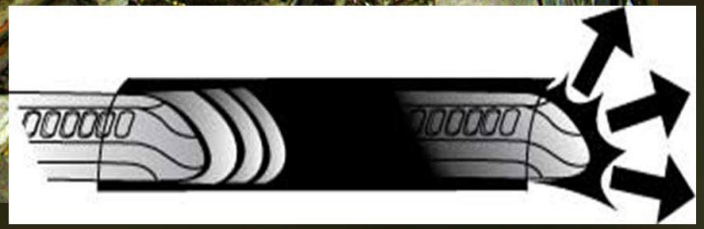


Primer tren de alta velocidad

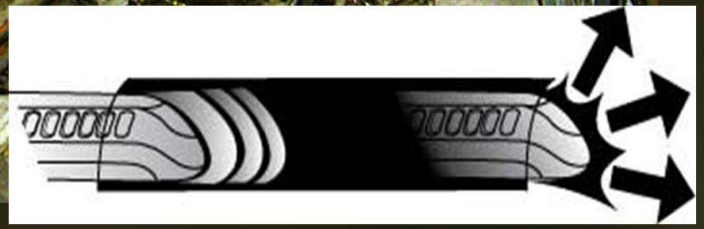
Shikansen Bullet Train 1964

64 millones pasajeros/día

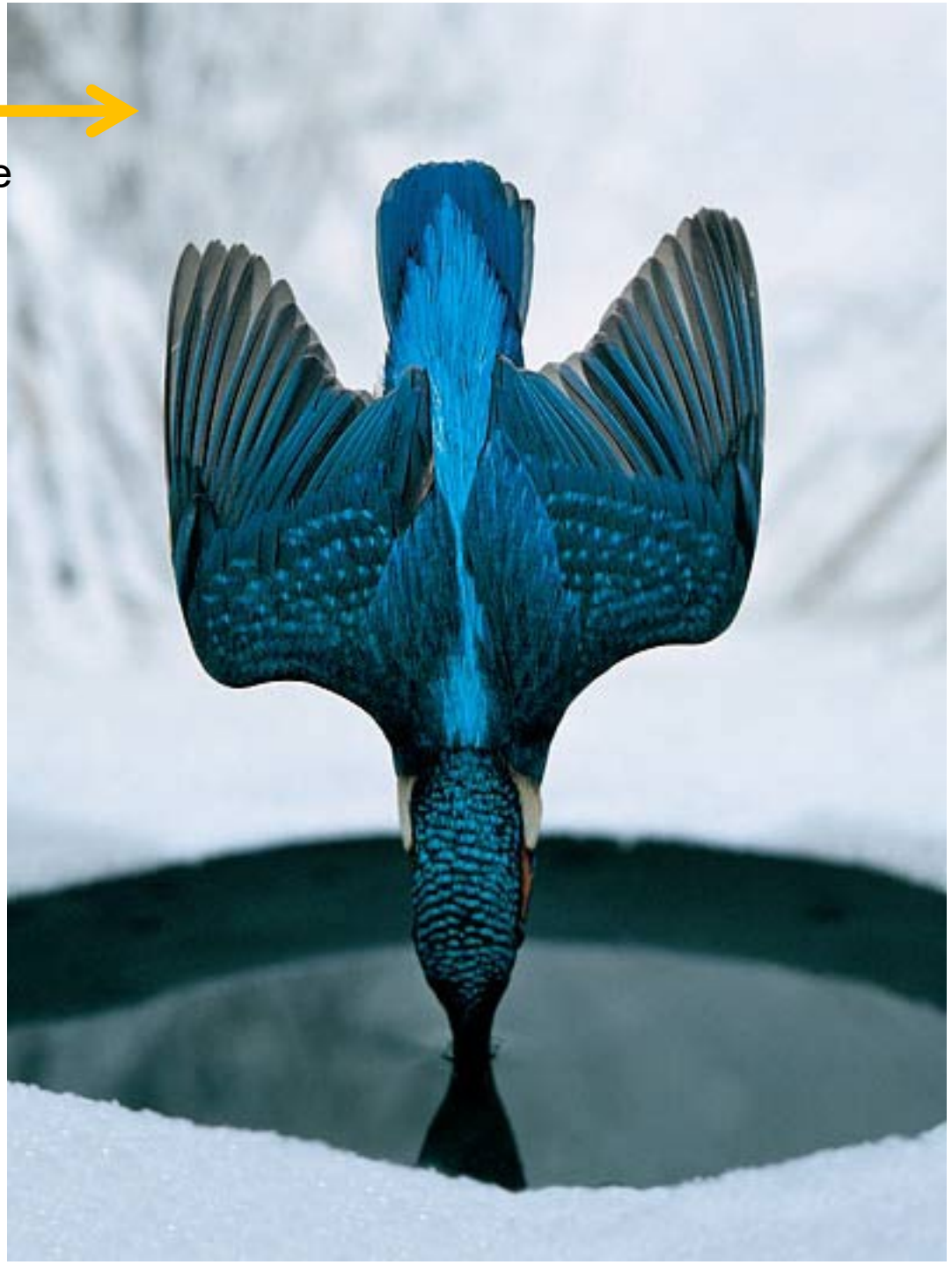

祝

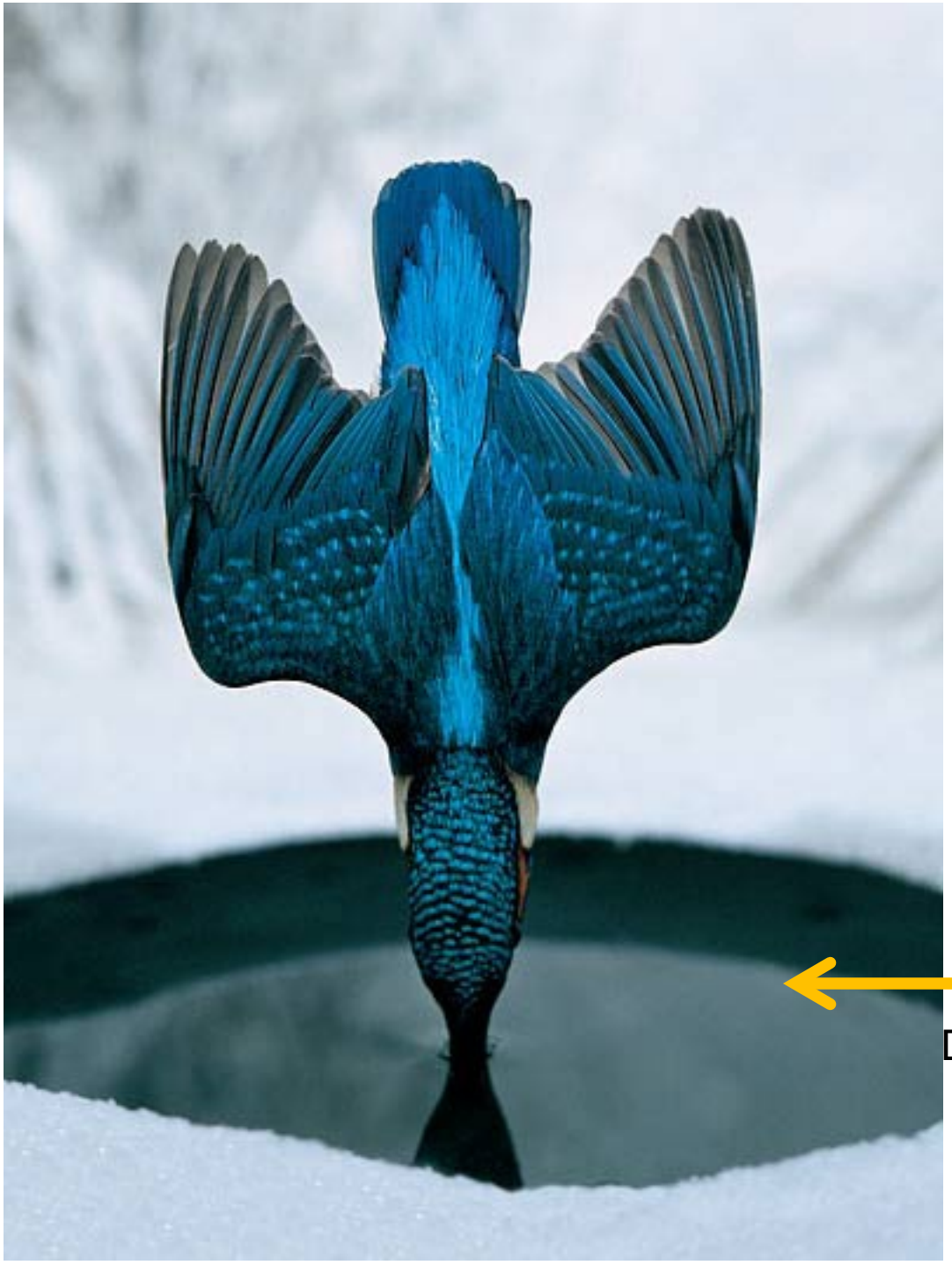



祝

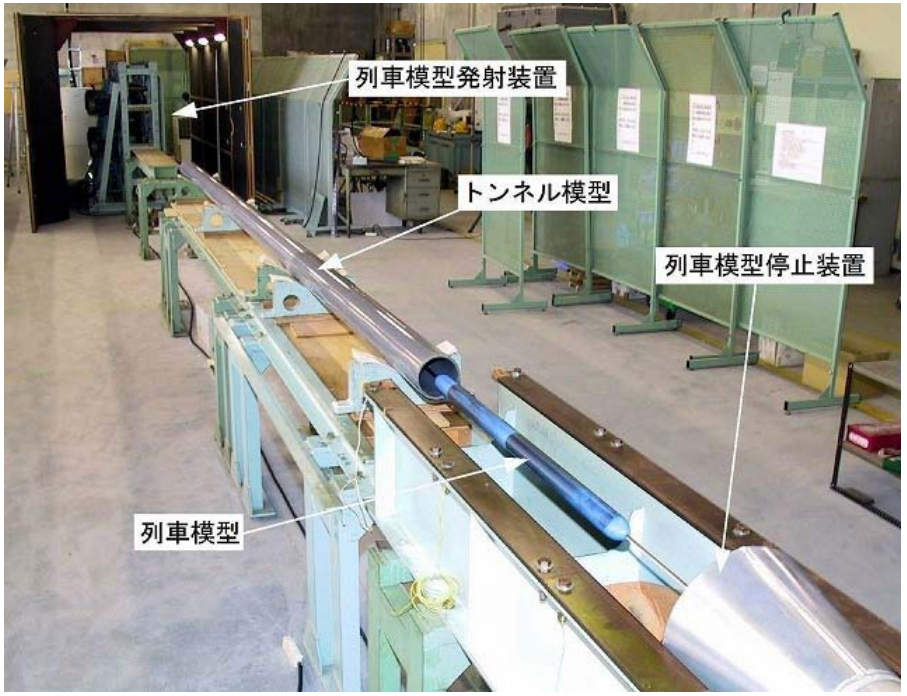


Densidad en el aire



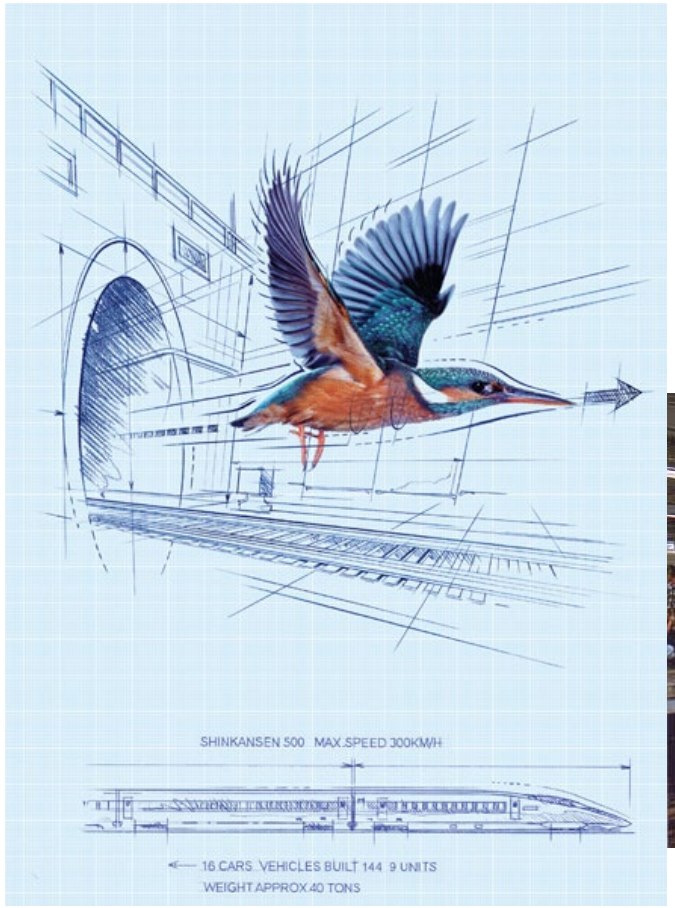


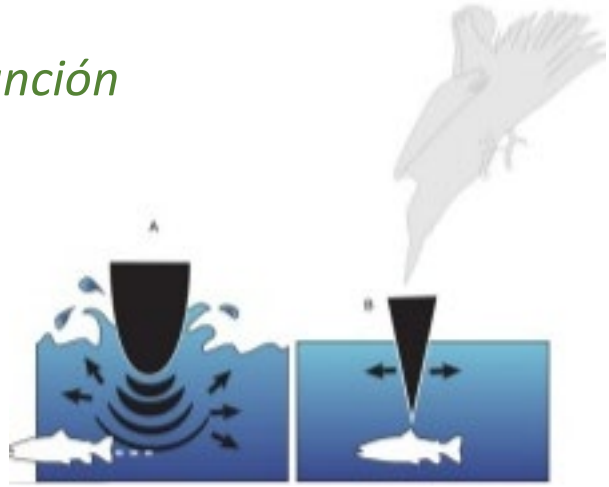
Densidad en el agua



Testaje en túnel del viento

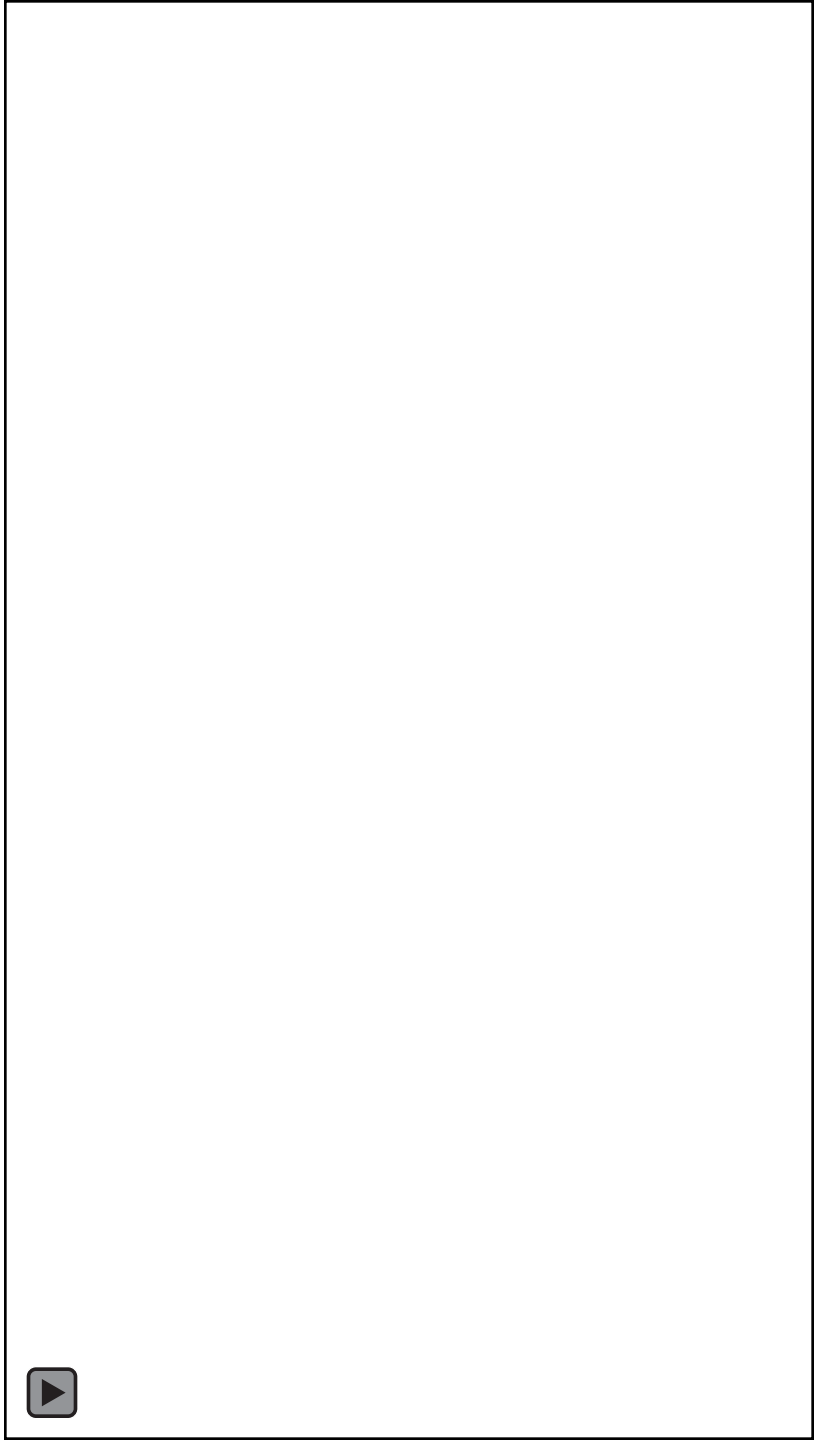
pensamiento analógico *forma=función*

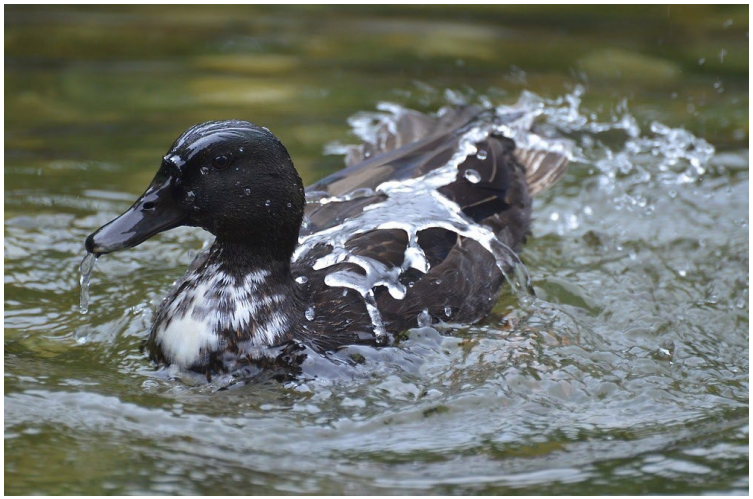




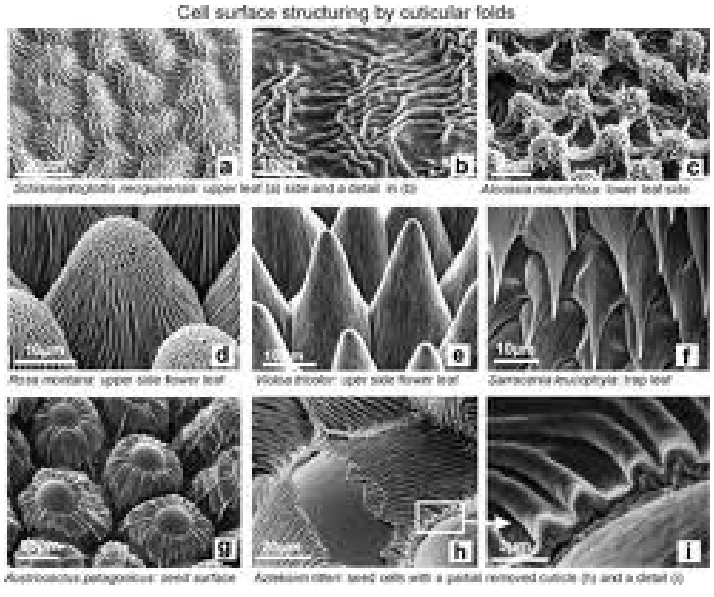
+ 300km/ hora
Sin ruido al entrar en túneles (legalidad)
30% ahorro energético

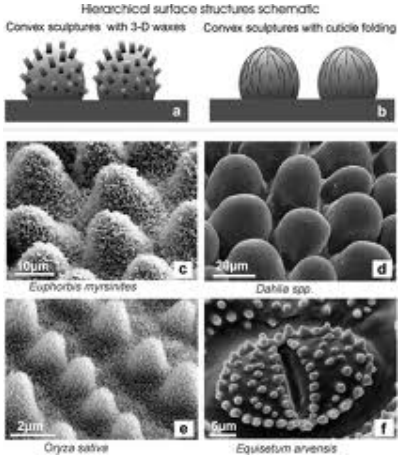
Que pueden enseñarnos las hojas sobre la autolimpieza??

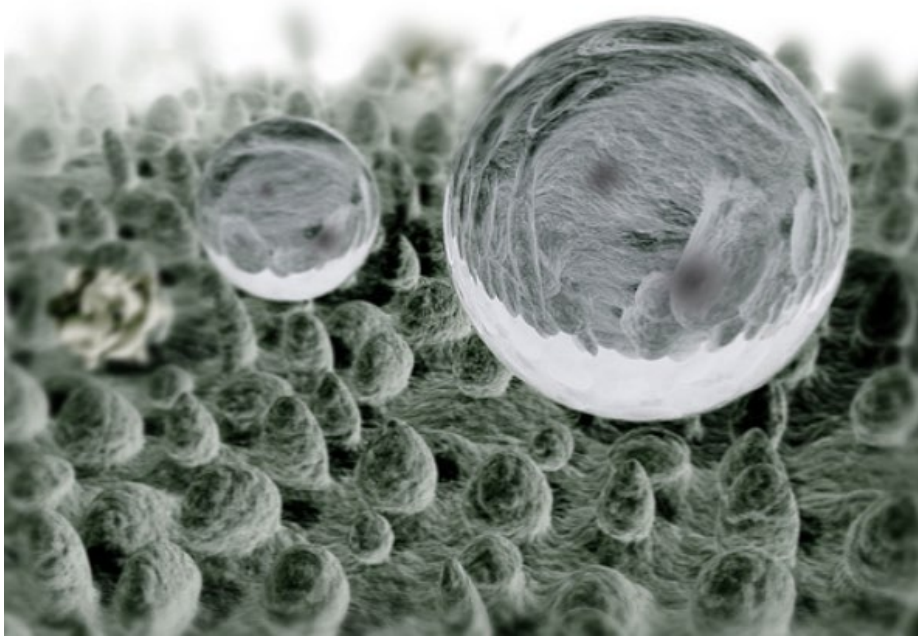


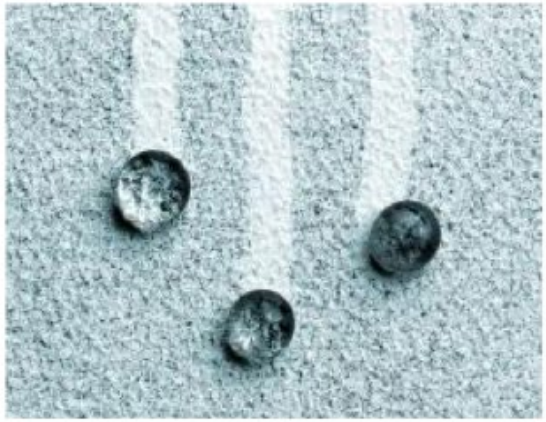


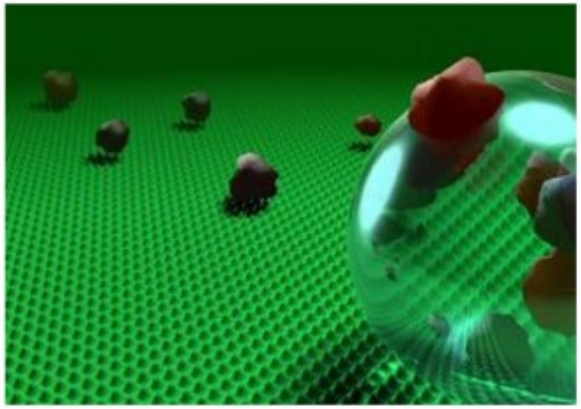
LOTUSAN


Cell surface structuring by cuticular folds
a
b
c
d
e
f
g
h
i


Hierarchical surface structures schematic
Convex sculptures with 3-D waxes
Convex sculptures with cuticle folding
a
b
10µm
c
Euphorbia myrsinites
2µm
d
Dahlia spp.
2µm
e
Oryza sativa
5µm
f
Equisetum arvensis



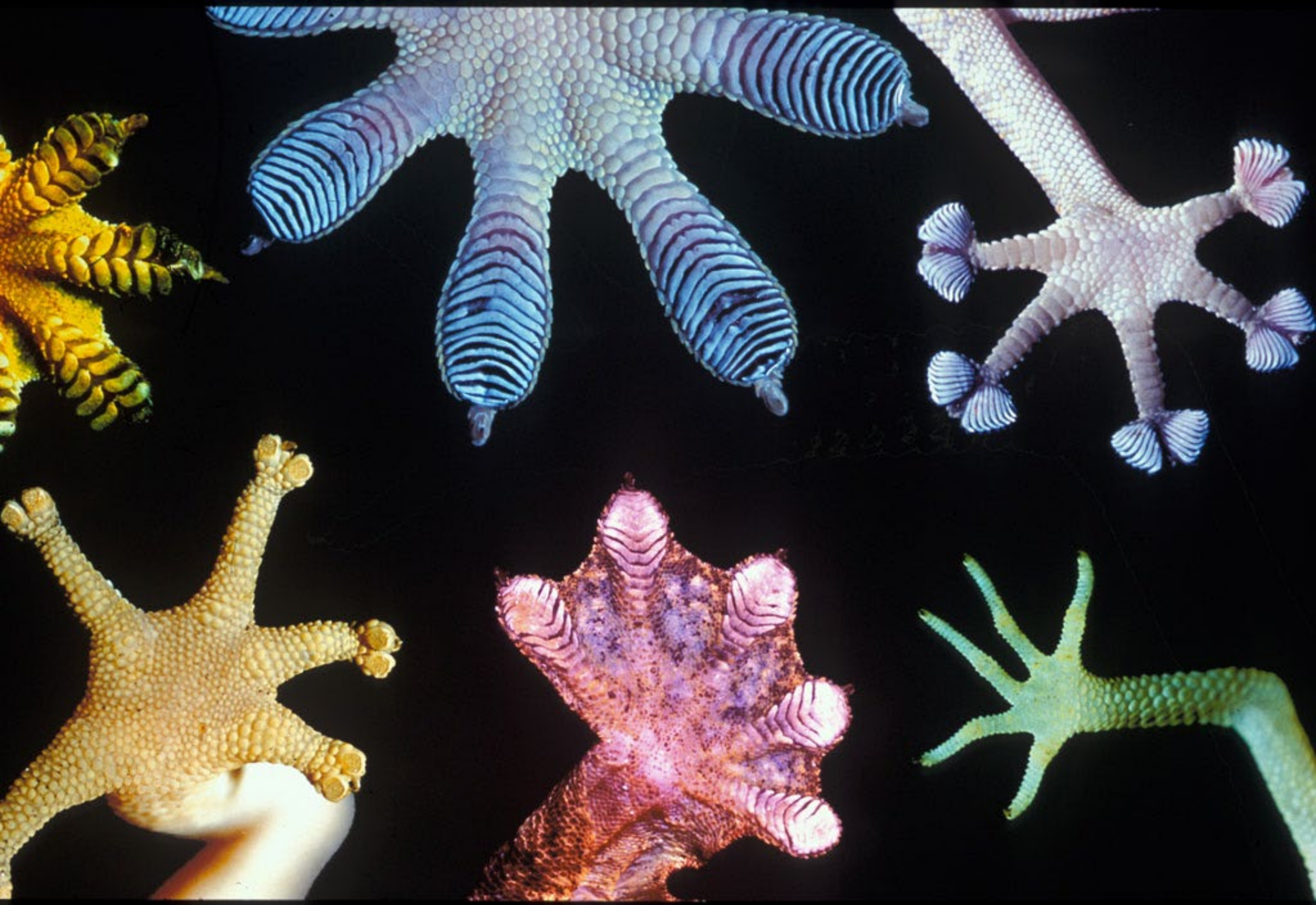


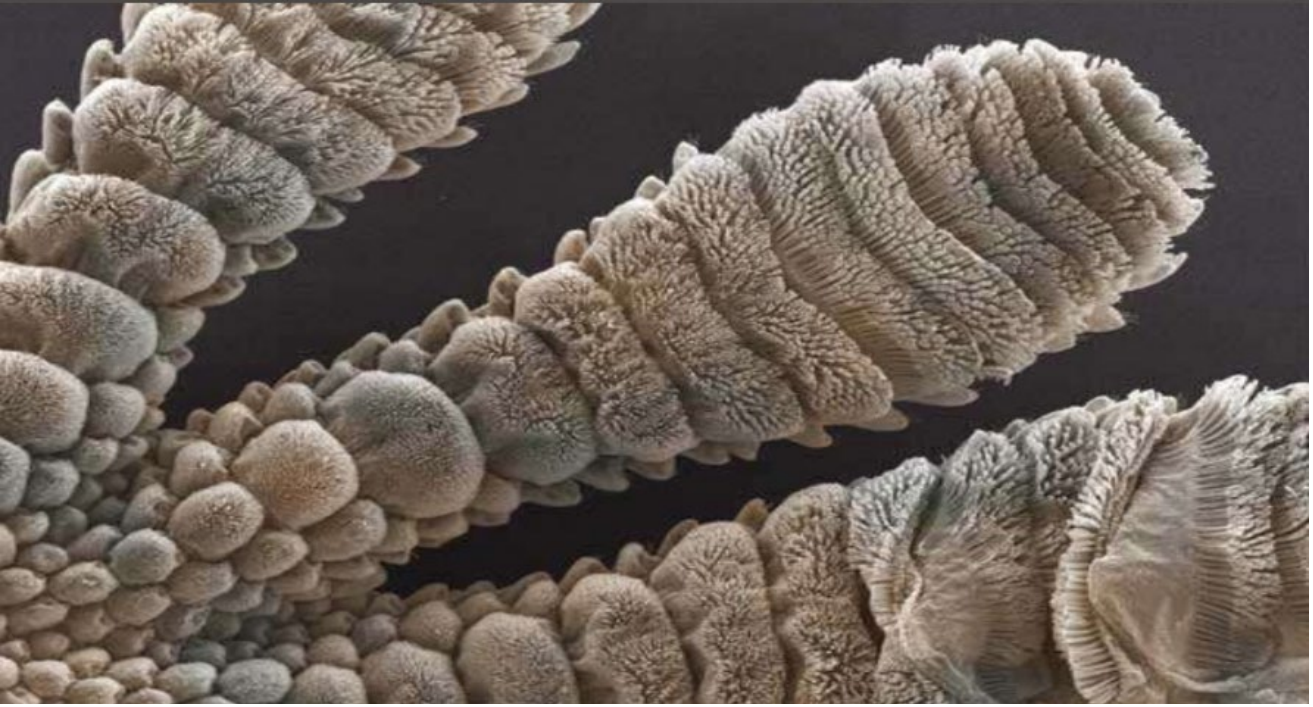


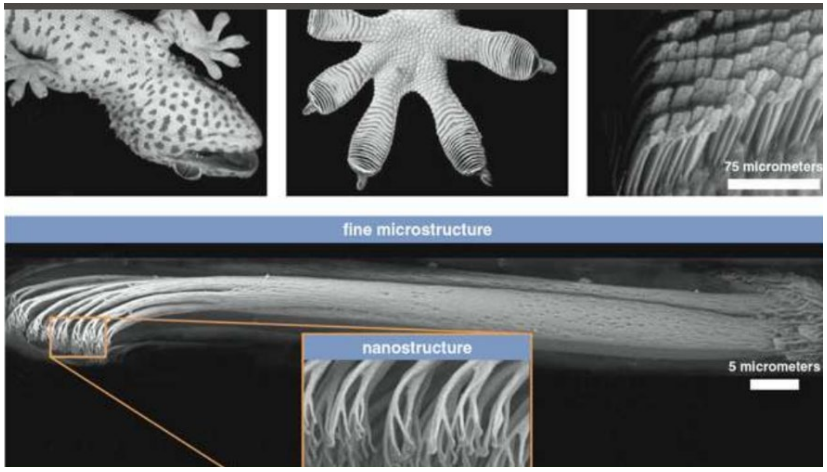
ispo.

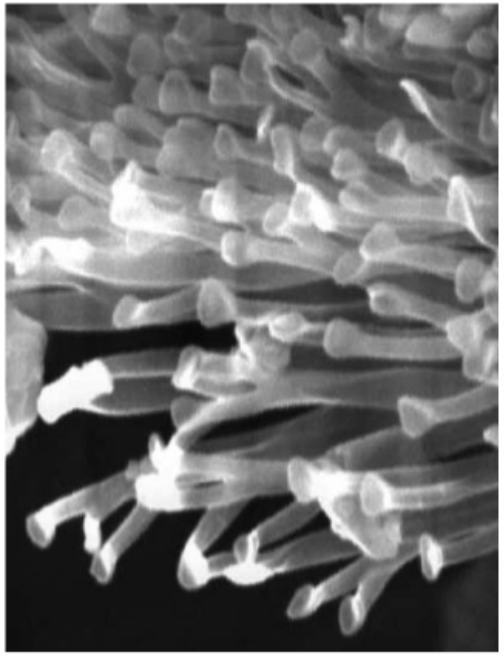
Superhidrofobicidad
Efecto Lotus


Que pueden enseñarnos las salamanquesas sobre pegamentos?

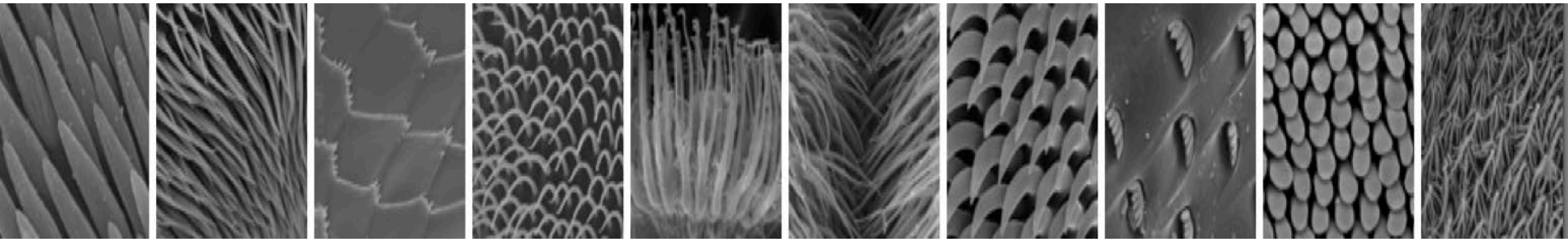








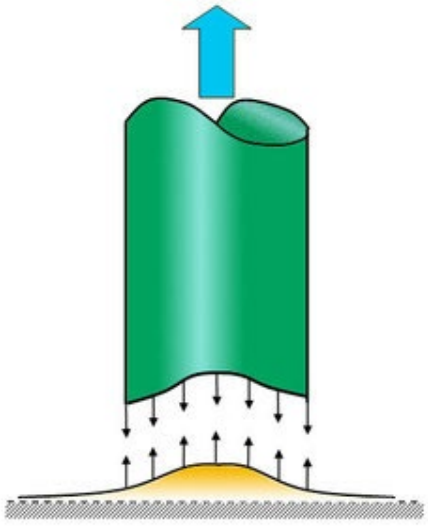
Fuerzas de Van der Waals



mecanismo: fuerzas de **Van der Waals**

es la suma de las fuerzas atractivas o repulsivas entre moléculas distintas de los enlaces covalentes que se obtiene cuando la superficie de contacto es pequeña como 100 nm.

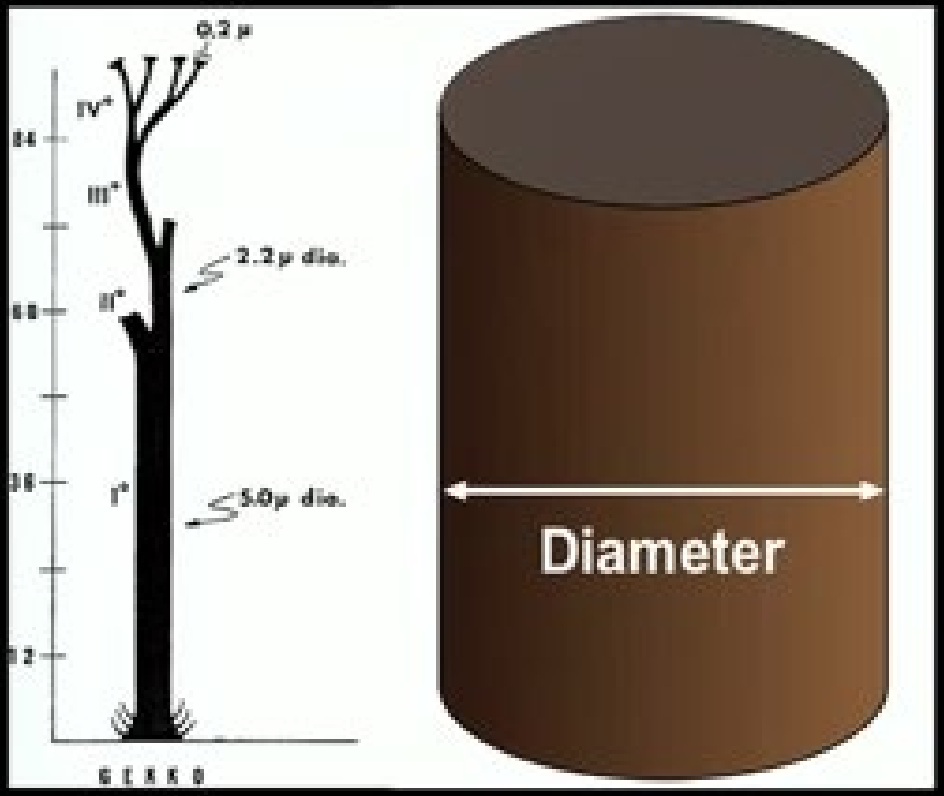
1 mm = 1.000.000 nanometros

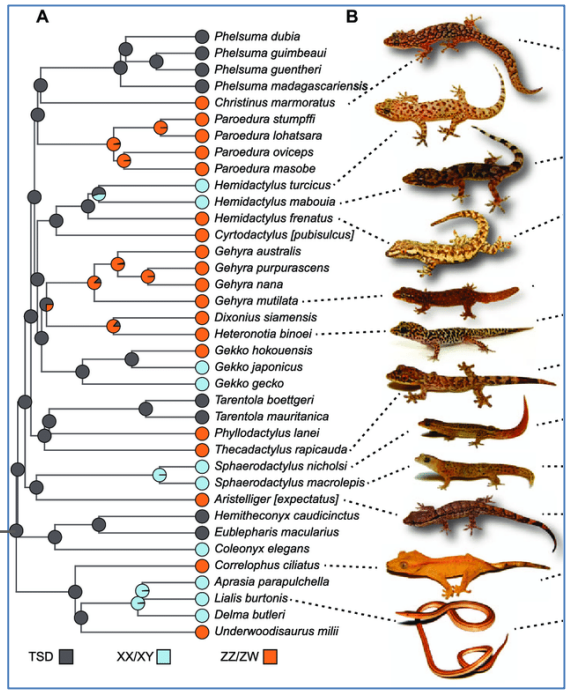


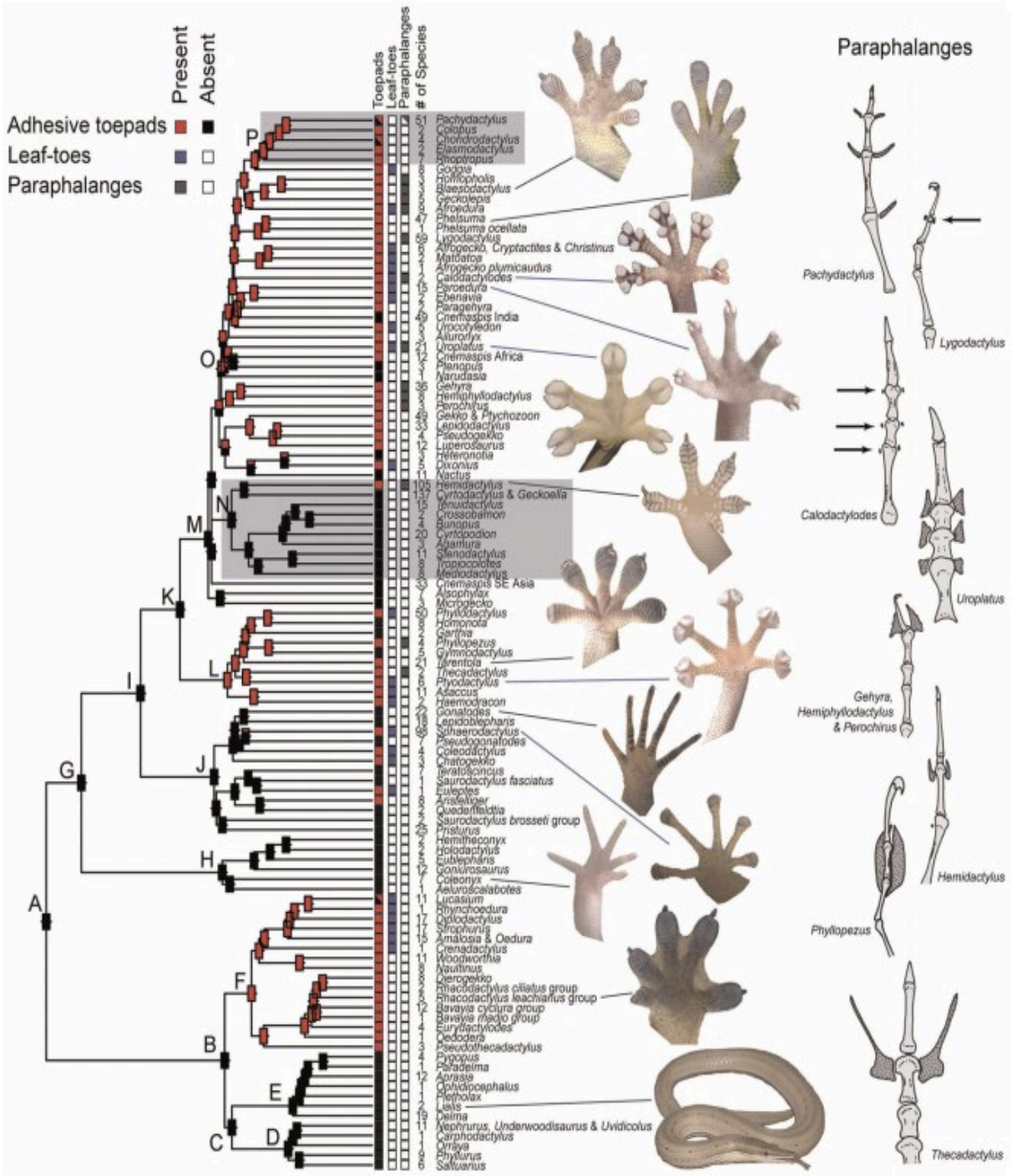
Geckos have Hairy Toes

Gecko Toe Hair

Your Head Hair



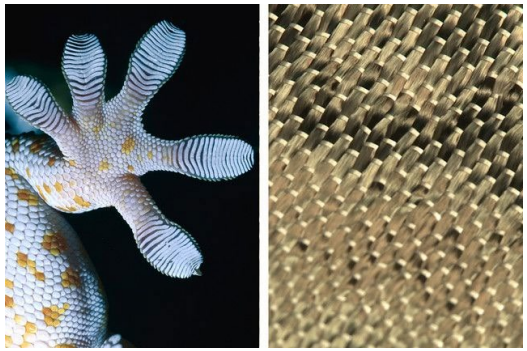

A
B
Phelsuma dubia
Phelsuma guimbeaui
Phelsuma guentheri
Phelsuma madagascariensis
Christinus marmoratus
Paroedura stumpffi
Paroedura lohatsara
Paroedura oviceps
Paroedura masobe
Hemidactylus turcicus
Hemidactylus mabouia
Hemidactylus frenatus
Cyrtodactylus [pubisulcus]
Gehyra australis
Gehyra purpurascens
Gehyra nana
Gehyra mutilata
Dixonius siamensis
Heteronotia binoei
Gekko hokouensis
Gekko japonicus
Gekko gecko
Tarentola boettgeri
Tarentola mauritanica
Phyllodactylus lanei
Thecadactylus rapicauda
Sphaerodactylus nicholsi
Sphaerodactylus macrolepis
Aristelliger [expectatus]
Hemitheconyx caudicinctus
Eublepharis macularius
Coleonyx elegans
Correlophus ciliatus
Aprasia parapulchella
Lialis burtonis
Delma butleri
Underwoodisaurus milii
TSD
XX/XY
ZZ/ZW


Present
Absent
Adhesive toepads
Leaf-toes
Paraphalanges
Toepads
Leaf-toes
Paraphalanges
# of Species
P
O
N
M
K
L
I
J
G
H
A
F
B
E
C
D
Paraphalanges
Pachydactylus
Lygodactylus
Calodactylodes
Uroplatus
Gehyra, Hemiphyllodactylus & Perochirus
Hemidactylus
Phyllopezus
Thecadactylus

Interface FLOR

Interface FLOR


2" X 5 YDS.
GECKO GRIP
MULTIPURPOSE TAPE
NORTH AMERICAN RESCUE PRODUCTS



gecko tapes

GECKO BIOMEDICAL

karplab

GECKO BIOMEDICAL

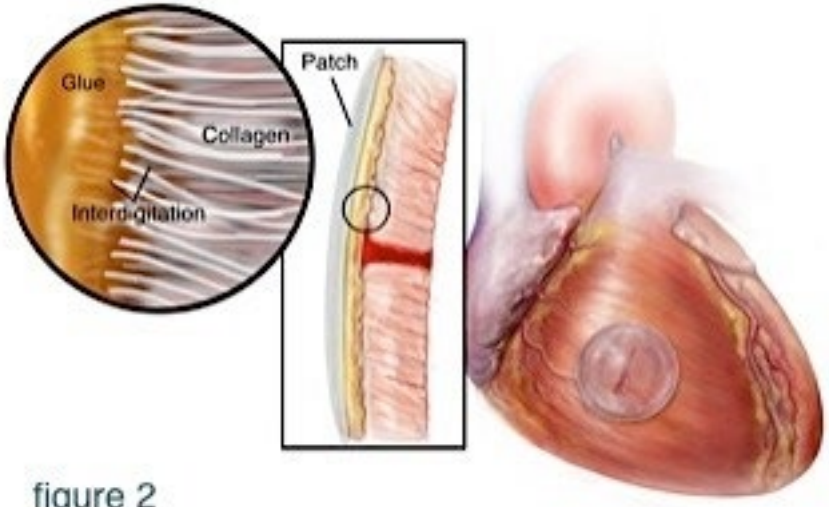


figure 2

Gecko Biomedical received 1.3 million euros from Bpifrance to advance its bio-inspired Surgical Adhesive Solutions

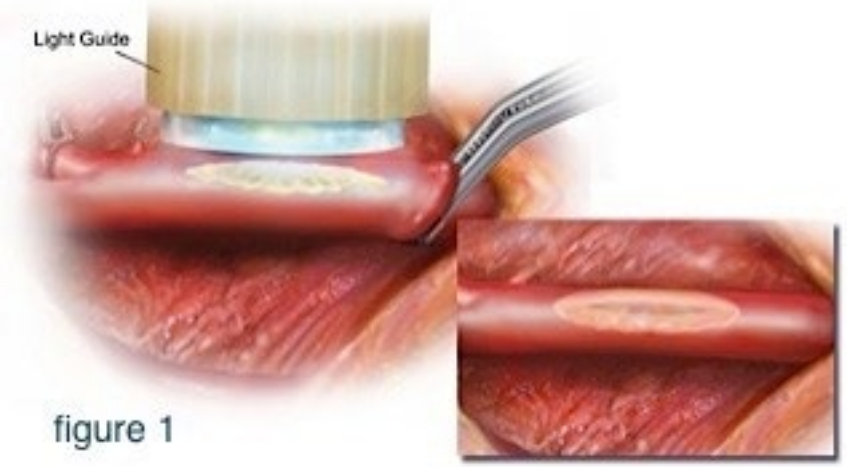
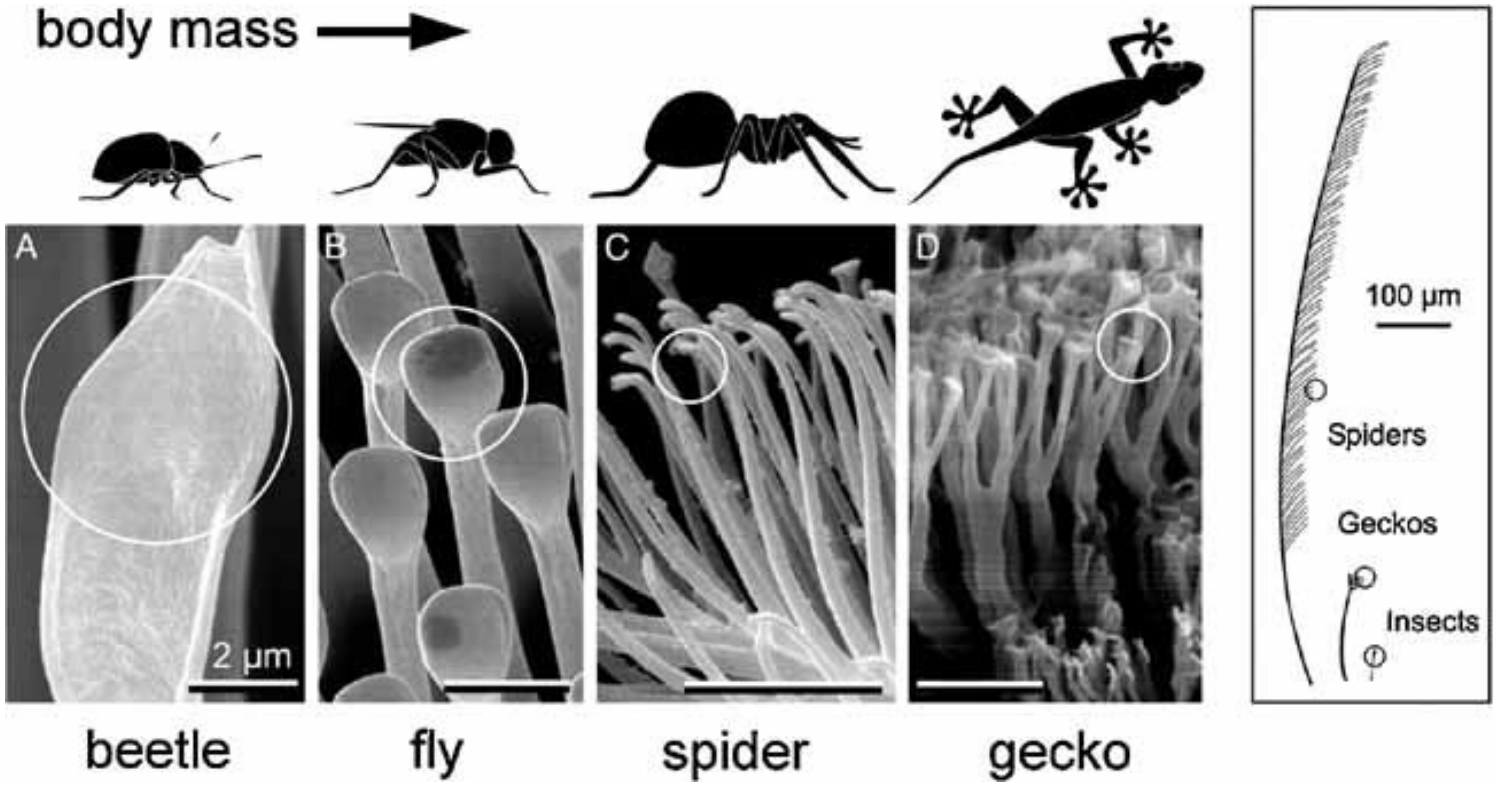
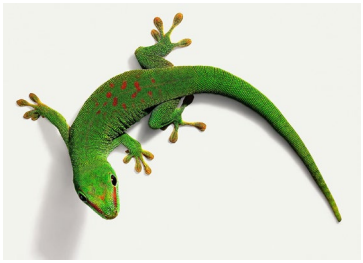


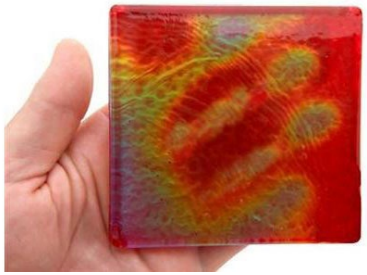
figure 1


body mass
A
B
C
D
2 µm
100 µm
Spiders
Geckos
Insects
beetle
fly
spider
gecko

Cual es la conexión entre…??

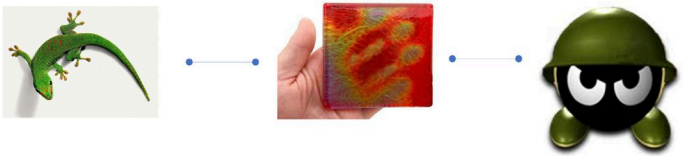
Gecko — nuevo material — super eficiente mini robot?

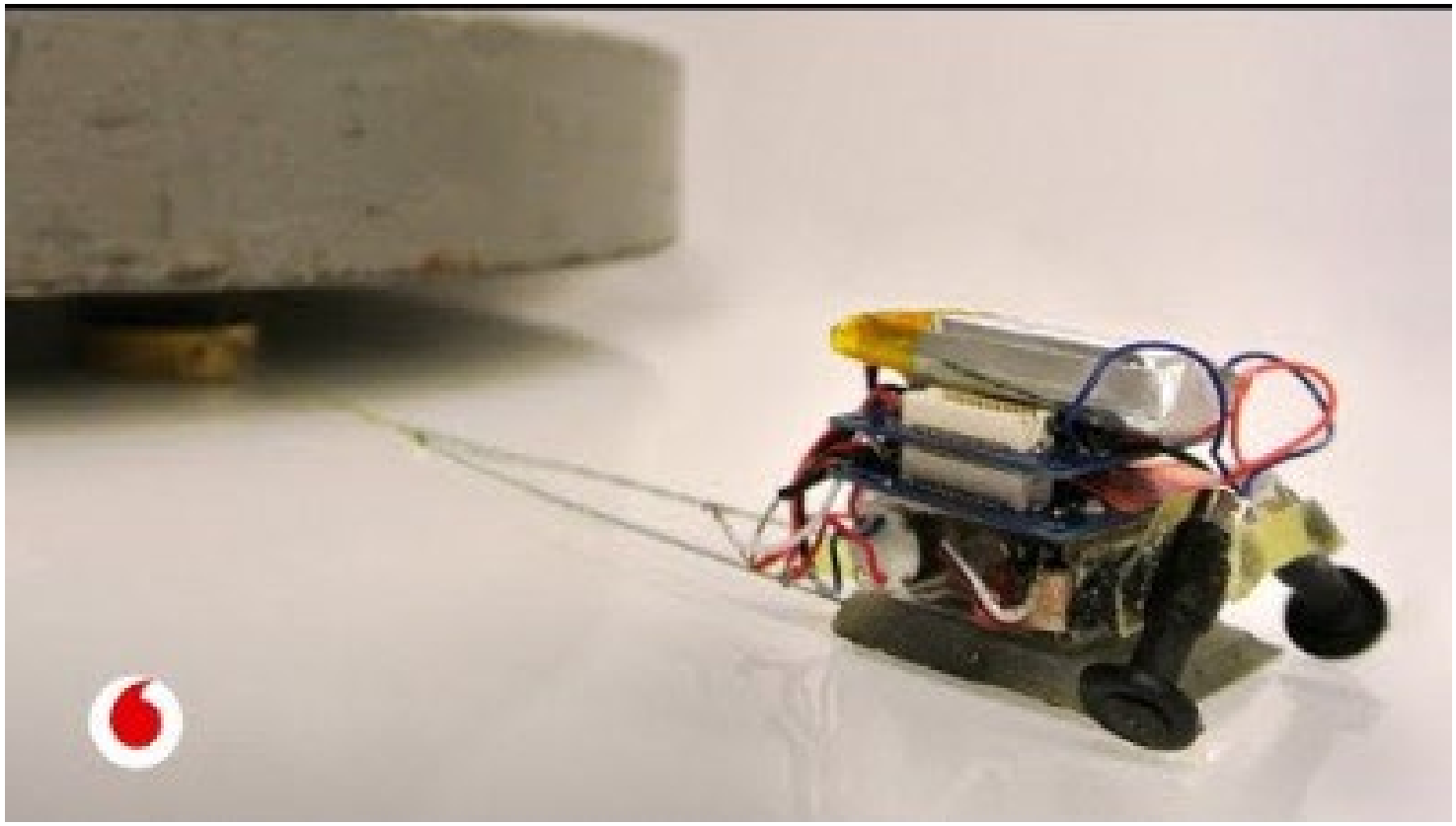




https://www.youtube.com/watch?v=AhF1qULHZSI

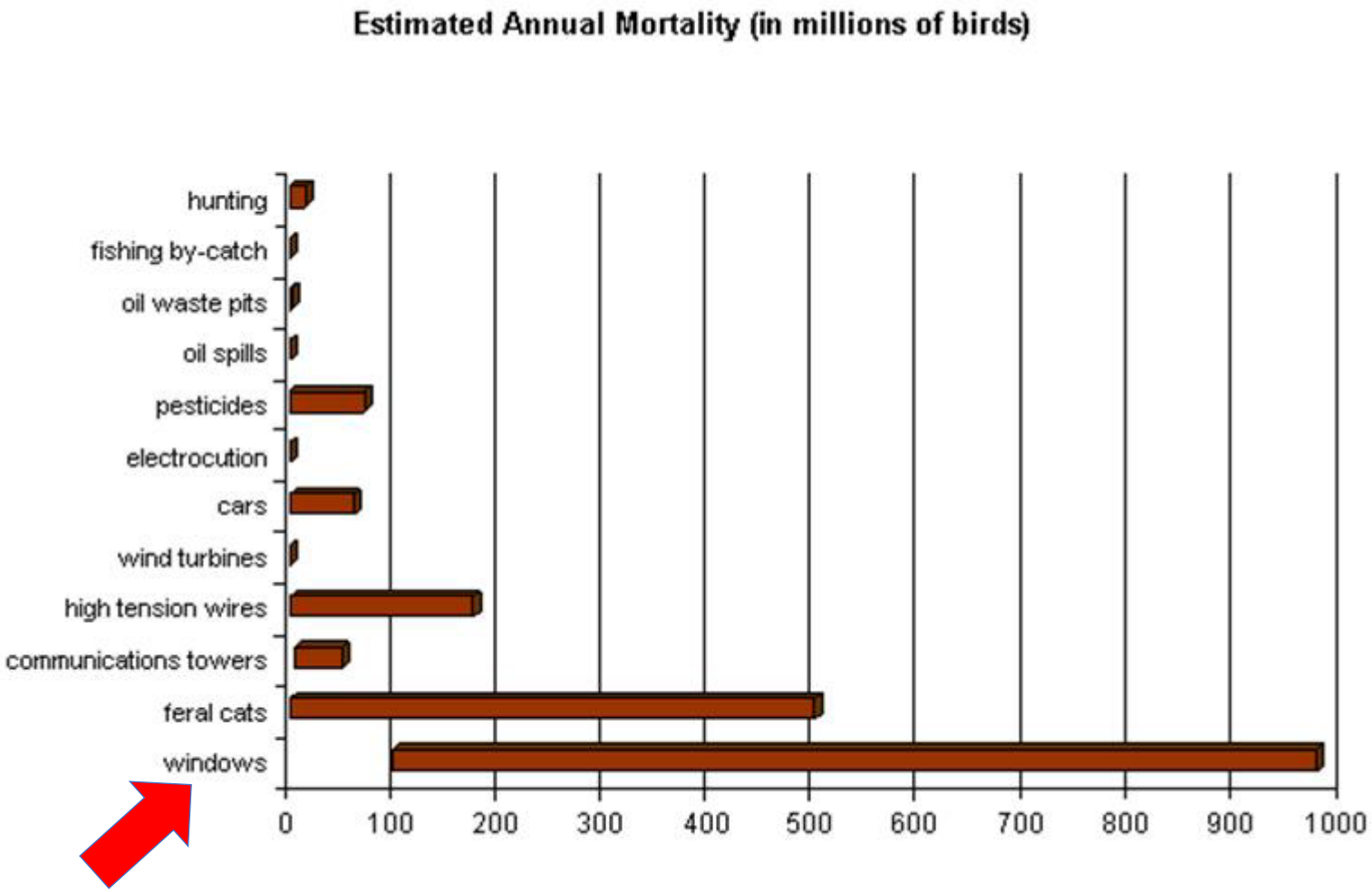
Gecko — nuevo material — supereficiente mini robot?





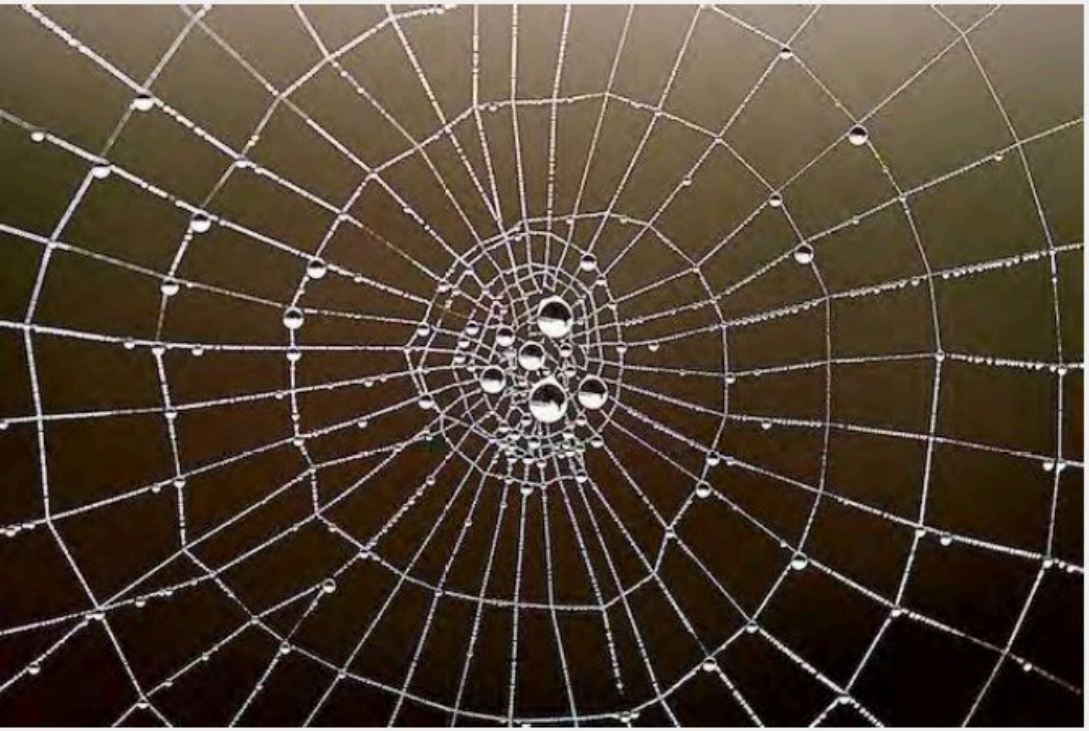
https://youtu.be/AhF1qULHZSI

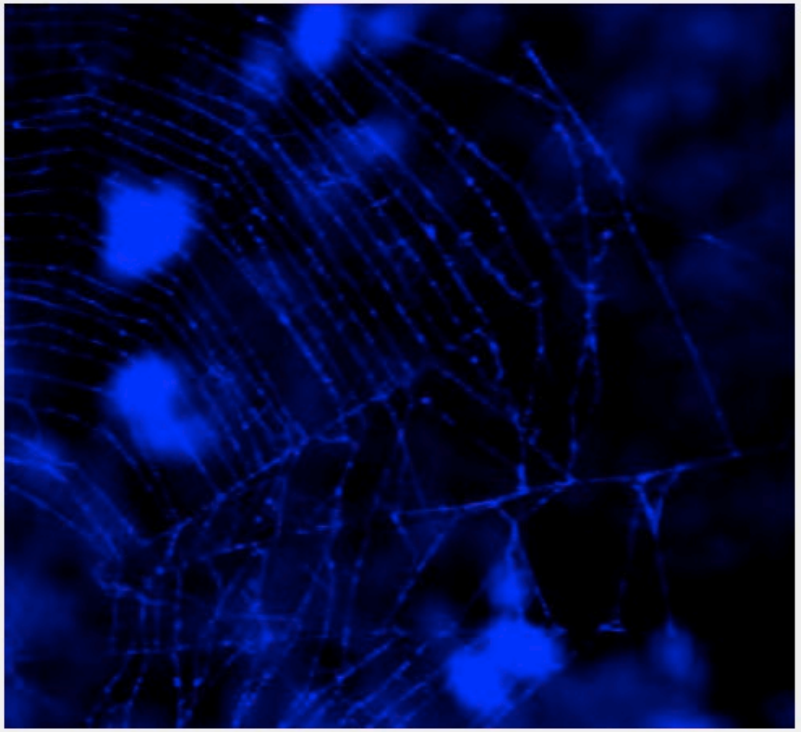
¿?

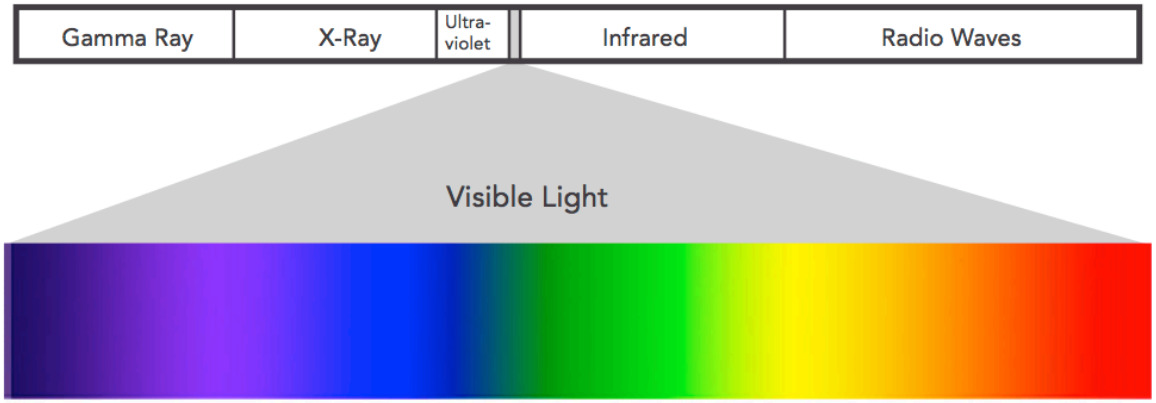


Sibley Guides


STEVE CREER



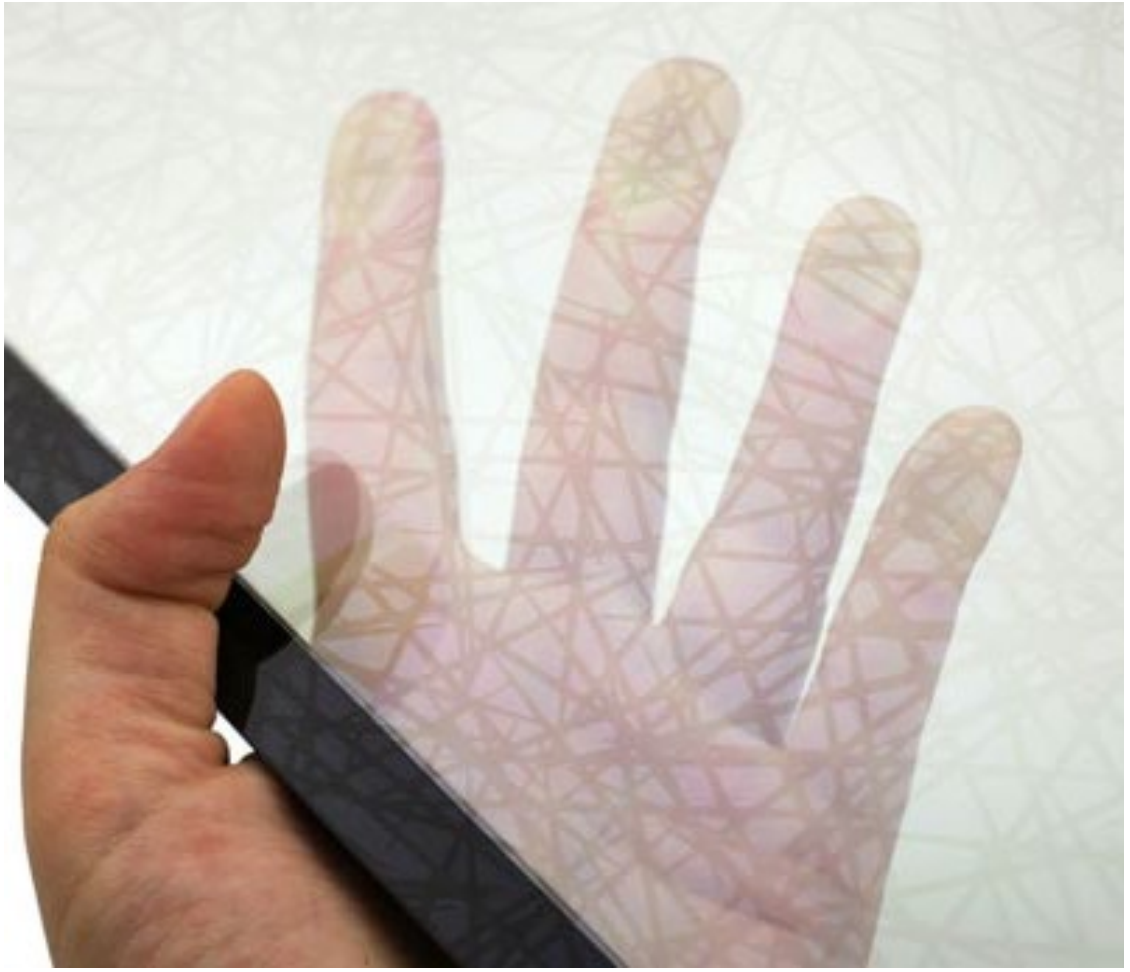




Visible light: the area of the electromagnetic spectrum visible to the human eye.

ORNILUX
Bird Protection Glass

Innovation by ARNOLDGLAS



CASOS DE EXITO BIOINSPIRADOS

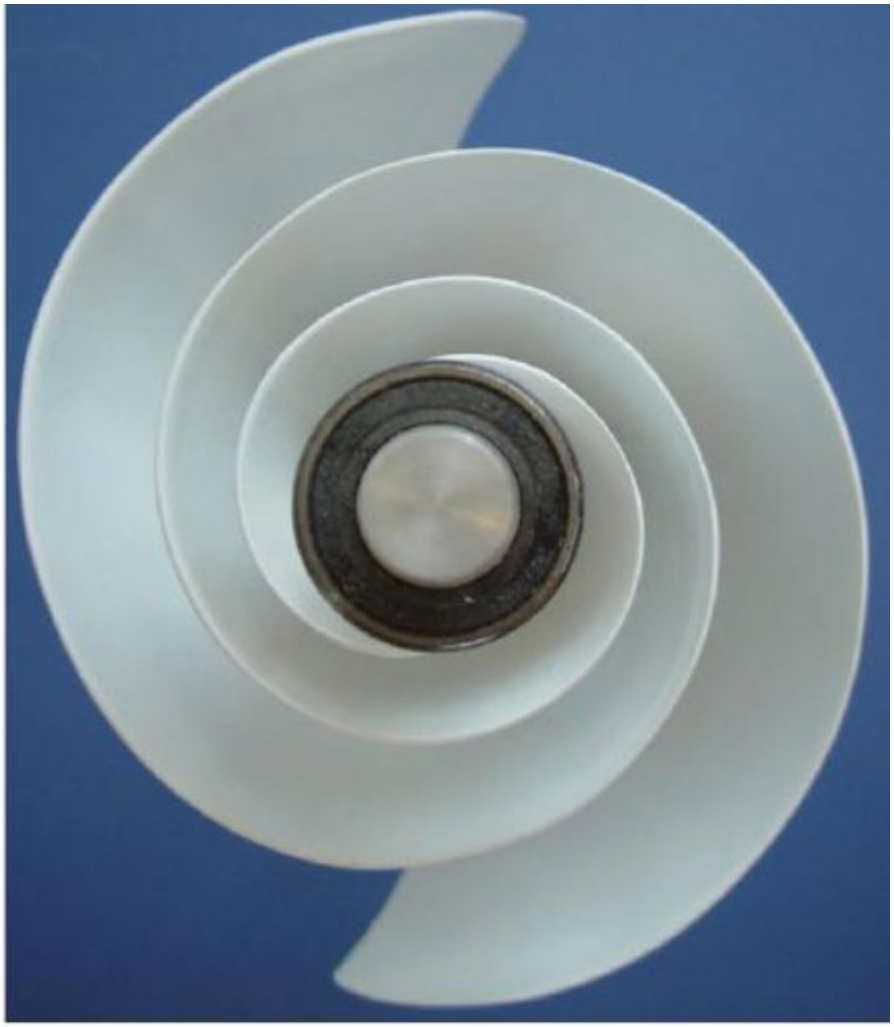
¿Que nos enseñan los vórtices en la optimización de motores?


Chad Coding

Nautilus Shell

Lily Impeller

PAX
WATER TECHNOLOGIES™



PAX Impeller

Photo courtesy of Jay Harman and PAX Scientific

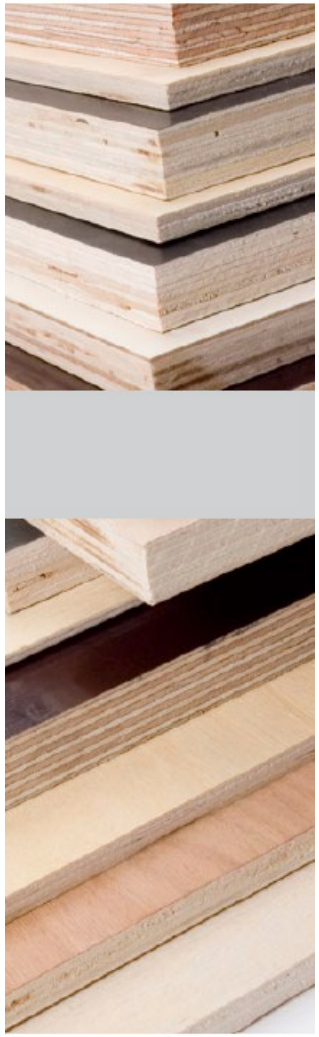
Vórtice
15 cm
40 millones de litros
3 bombillas de 100 wat

Tanque de 38.000.000 de litros (+120 m x 9 m alto)

https://www.youtube.com/watch?v=QCAk2Ge5wQE

https://www.youtube.com/watch?v=QbskDwYI2dk

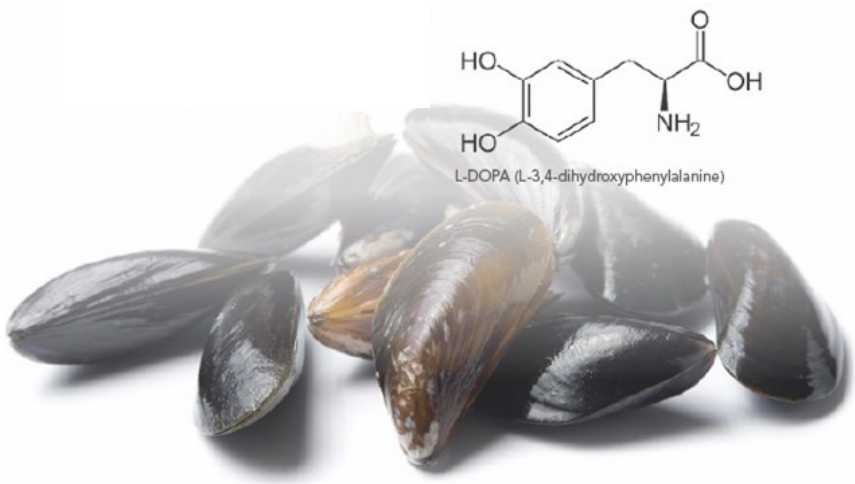

How Does the Mussel Grow its Beard...
California mussels
Mytilus californianus
SUBSCRIBE
0:10 / 4:00
YouTube



PureBond®
FORMALDEHYDE-FREE TECHNOLOGY

columbia
FOREST PRODUCTS™

Innovating Responsibly.™



L-DOPA (L-3,4-dihydroxyphenylalanine)

PureBond.
FORMALDEHYDE-FREE TECHNOLOGY

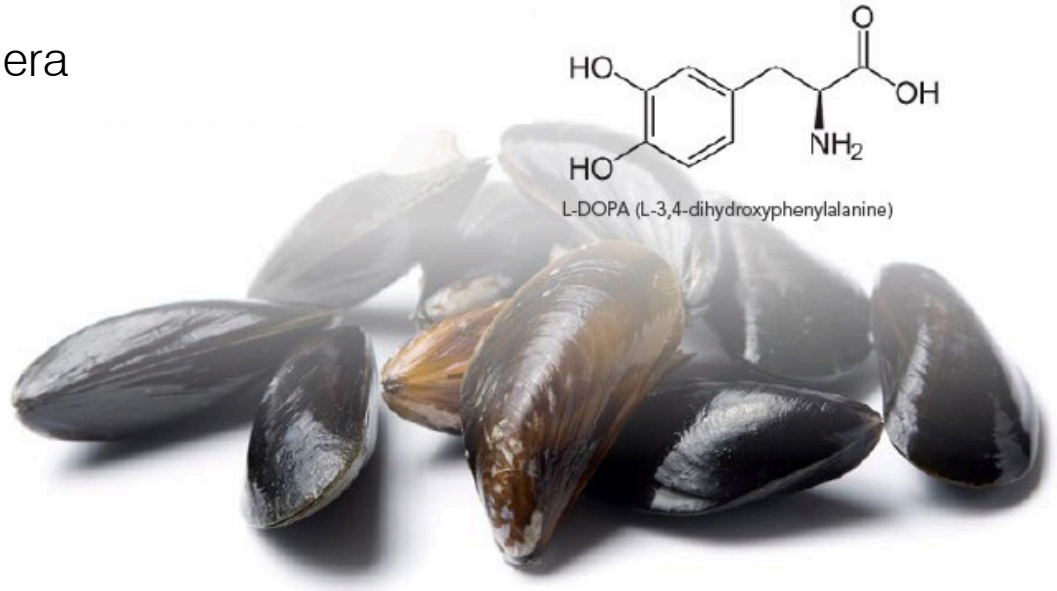
Proteínas Adhesivas Marinas

biso

aminoácidos únicos: 3,4 dihidrofenilalanina (L-DOPA)

Fuerte adherencia (teflón, acero, cristal…)

Potencial industria: Sector madera



PUREBOND® TECHNOLOGY: WOOD GLUE WITHOUT FORMALDEHYDE

Biomimicry Case Study: Biology To Design

On the wave-battered shores of the Oregon coast lives a hardy creature, the blue mussel. This mollusk uses small adhesive threads to attach to rocky surfaces in tidal zones, resisting the erosive forces of water and waves. The mussel's tenacious grip has inspired new wood glue technology called PureBond® that is nontoxic and sustainable, leading the way for innovation in the wood products industry.

PRODUCT	PureBond® Formaldehyde-free Hardwood Plywood Technology	
INNOVATORS	RESEARCHER	COMPANY
	Dr. Kaichang Li	Columbia Forest Products
WEBSITE	http://www.columbiaforestproducts.com/PureBond.aspx	
SUSTAINABILITY WIN	Nontoxic, soy-based adhesive that is formaldehyde-free	
EMULATING FORM, PROCESS, OR SYSTEM?	Process	
LIFE'S PRINCIPLE MET	Use life-friendly chemistry	

BIOMIMICRY Institute

The PureBond Timeline:

2000
Dr. Kaichang Li is inspired by mussels on the Oregon coast

2003
Steve Pung of Columbia Forest Products meets Dr. Li; CFP agrees to fund R&D efforts

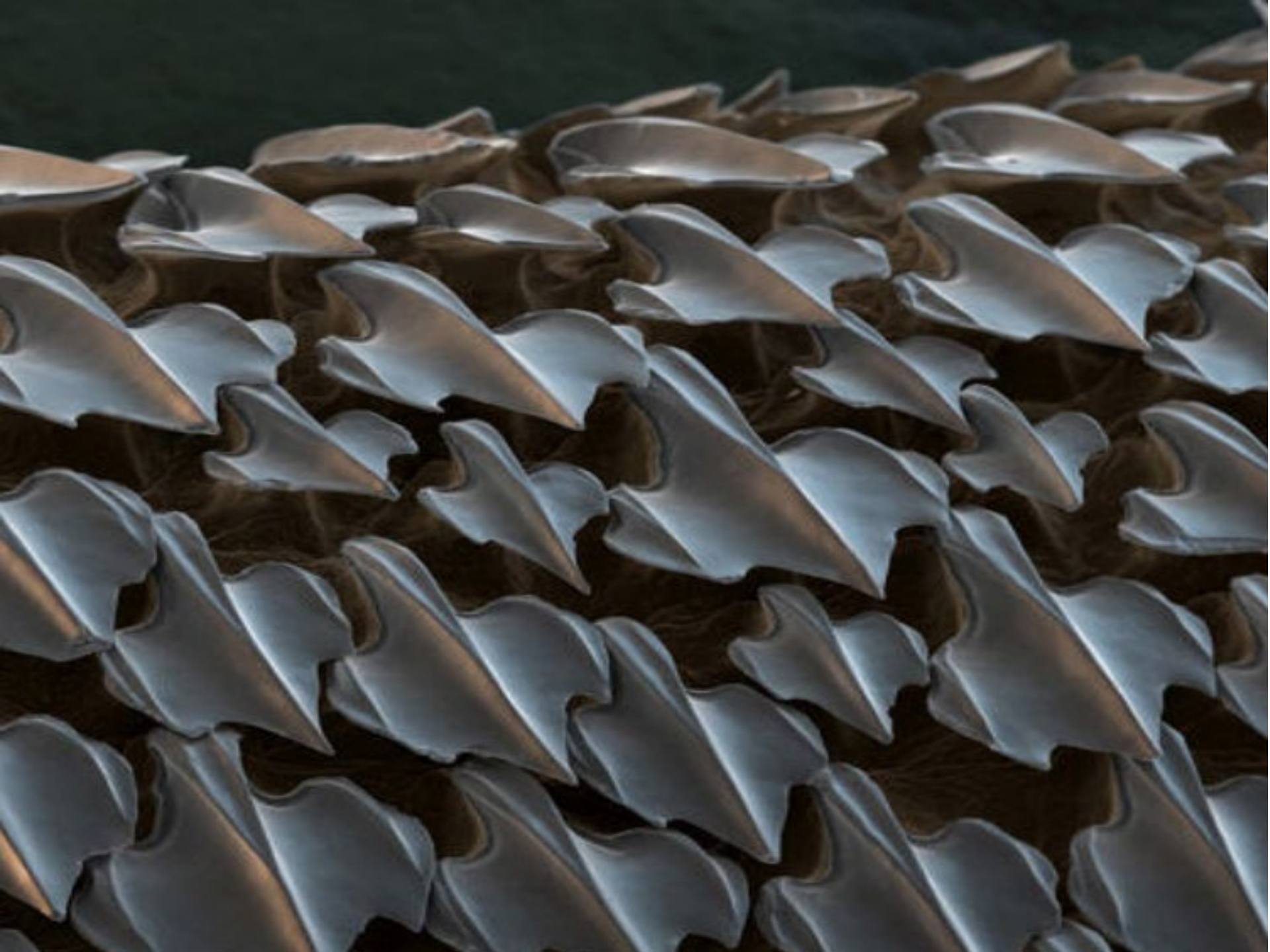
2005
PureBond announced to the public and production begins

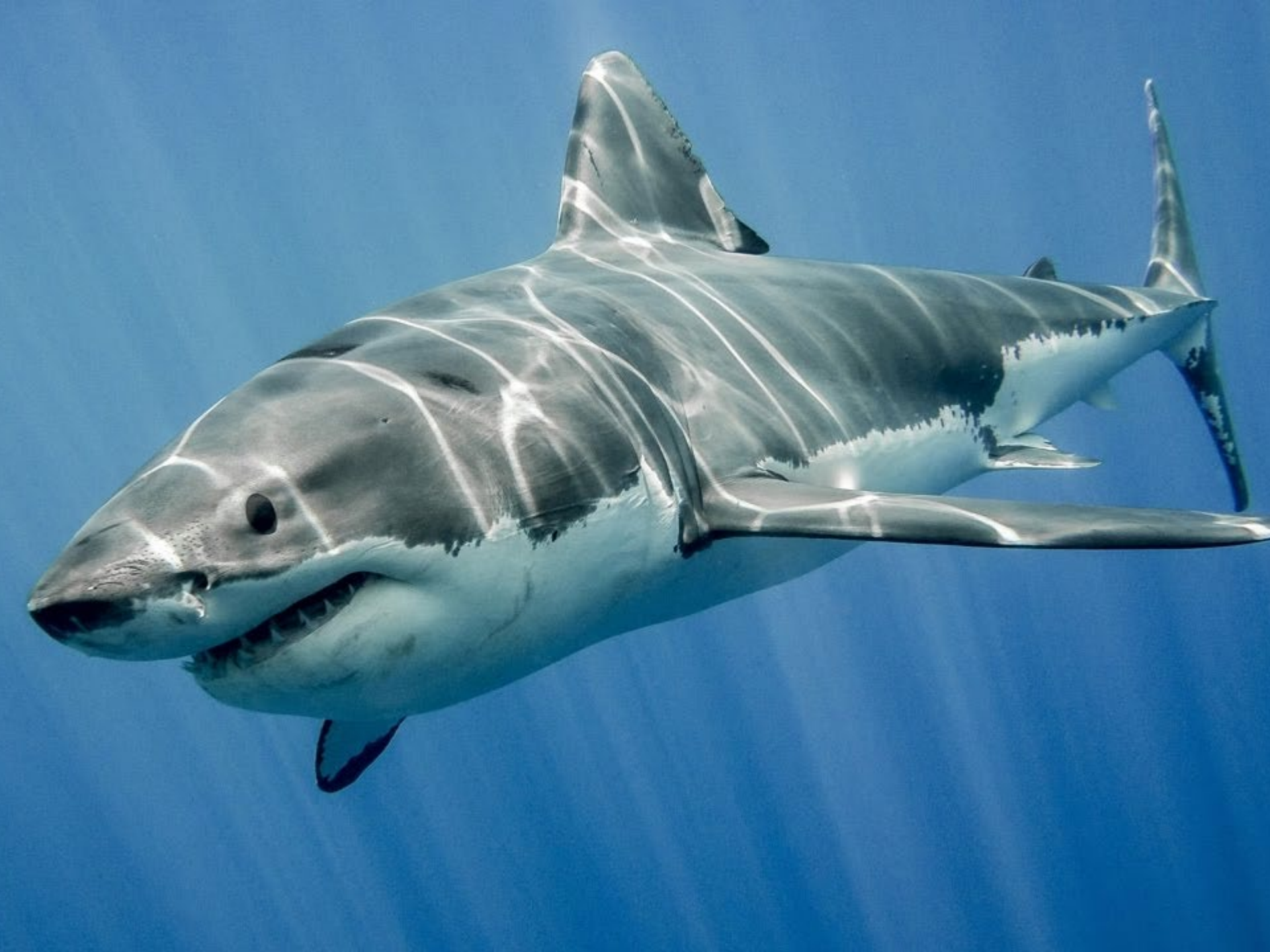
2006
CFP converts all 7 of its plywood plants to PureBond technology

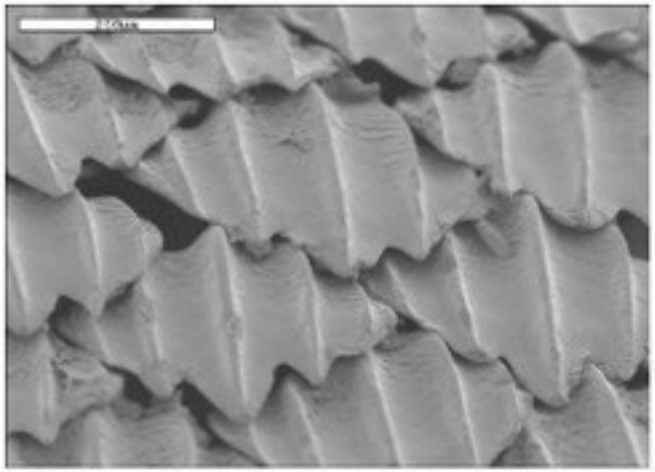
2007
Dr. Li, CFP, and Hercules, Inc. receive Presidential Green Chemistry Challenge Award

2008
CFP announces production of 25 millionth hardwood plywood panel using PureBond technology

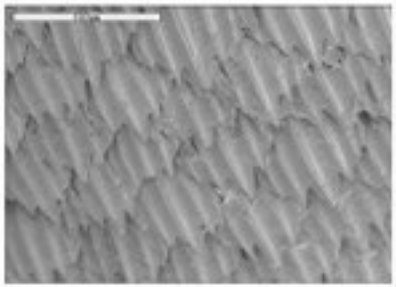
2010
Over 40 million PureBond panels have been manufactured and sold

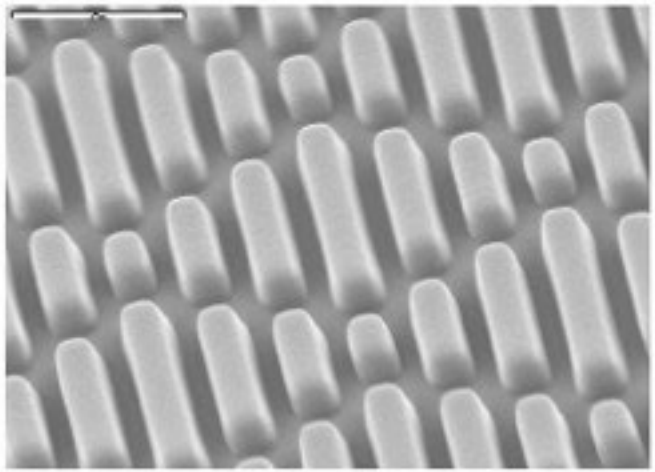




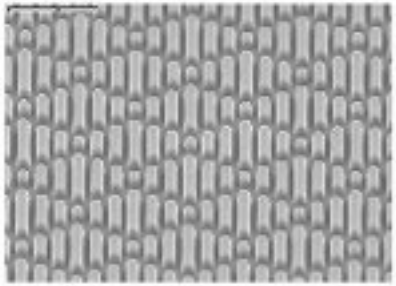


Real Galapagos shark skin (microscale)

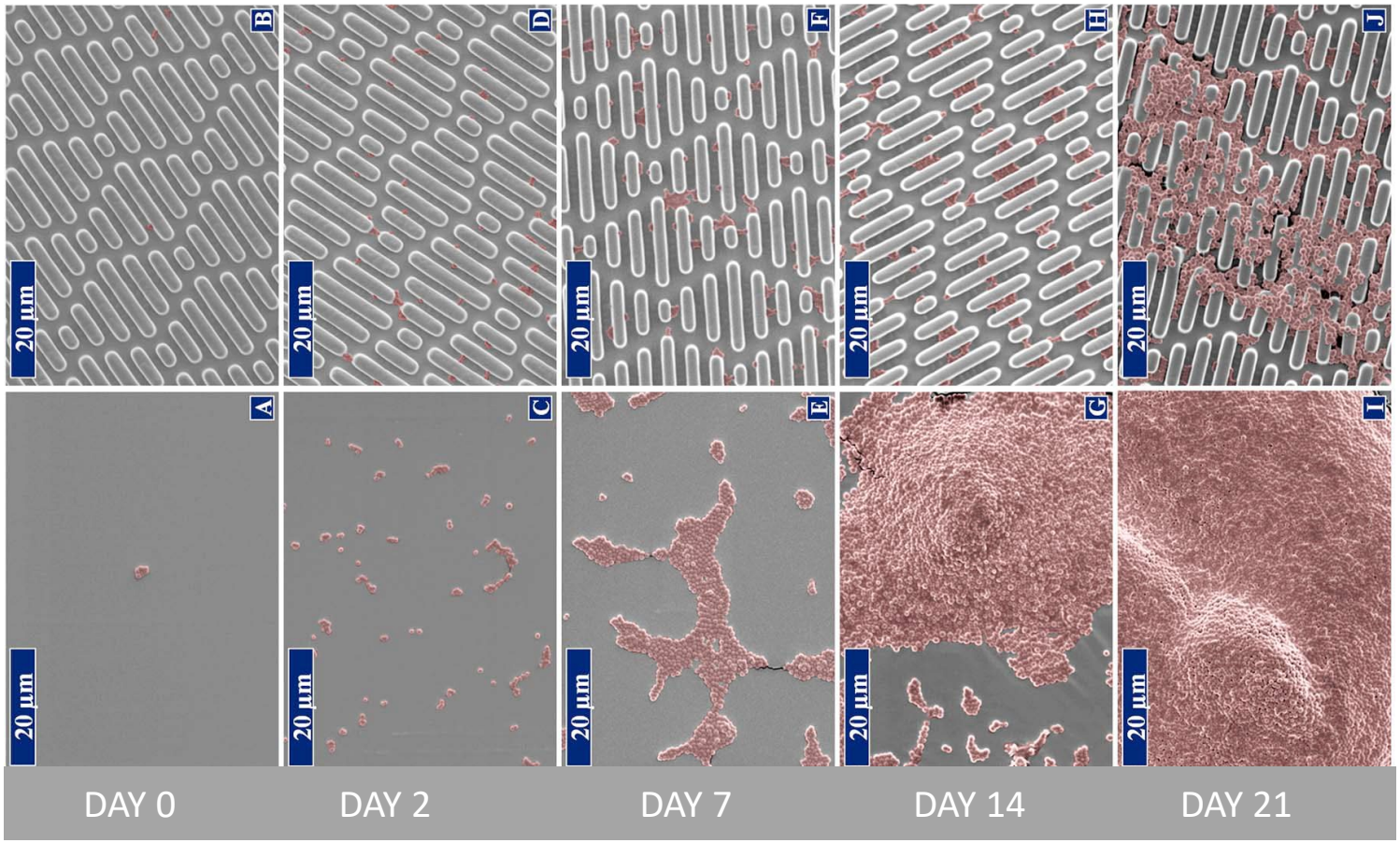




Sharklet technology pattern (microscale)



Sharklet™
TECHNOLOGIES, INC.



Sin antibióticos
Sin química
Sin aditivos

1 cell

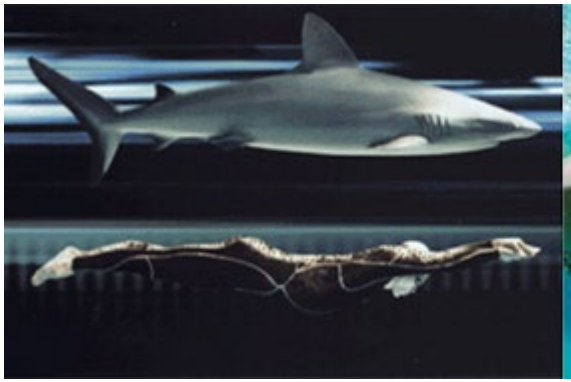
10 million

100 millions …

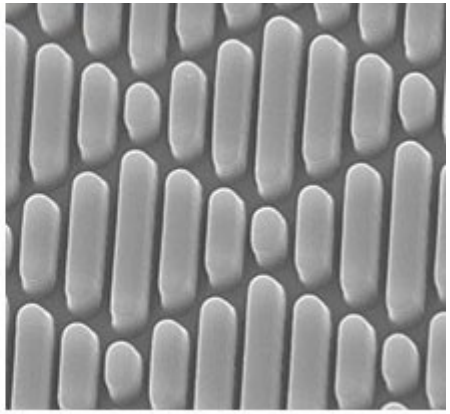
Sharklet™
TECHNOLOGIES, INC.

450 millones de años de experiencia en la Tierra

Sharklet™
TECHNOLOGIES, INC.

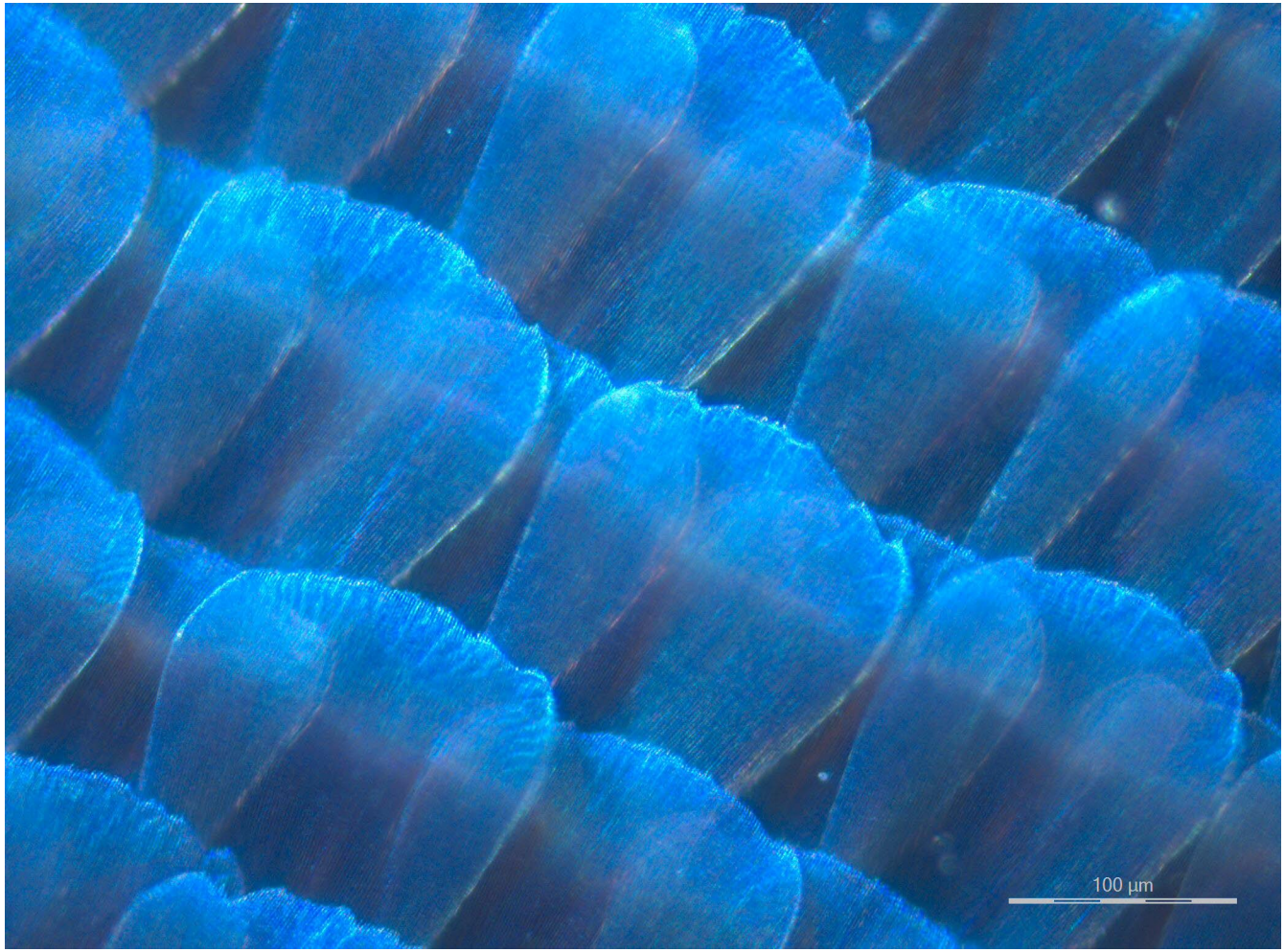


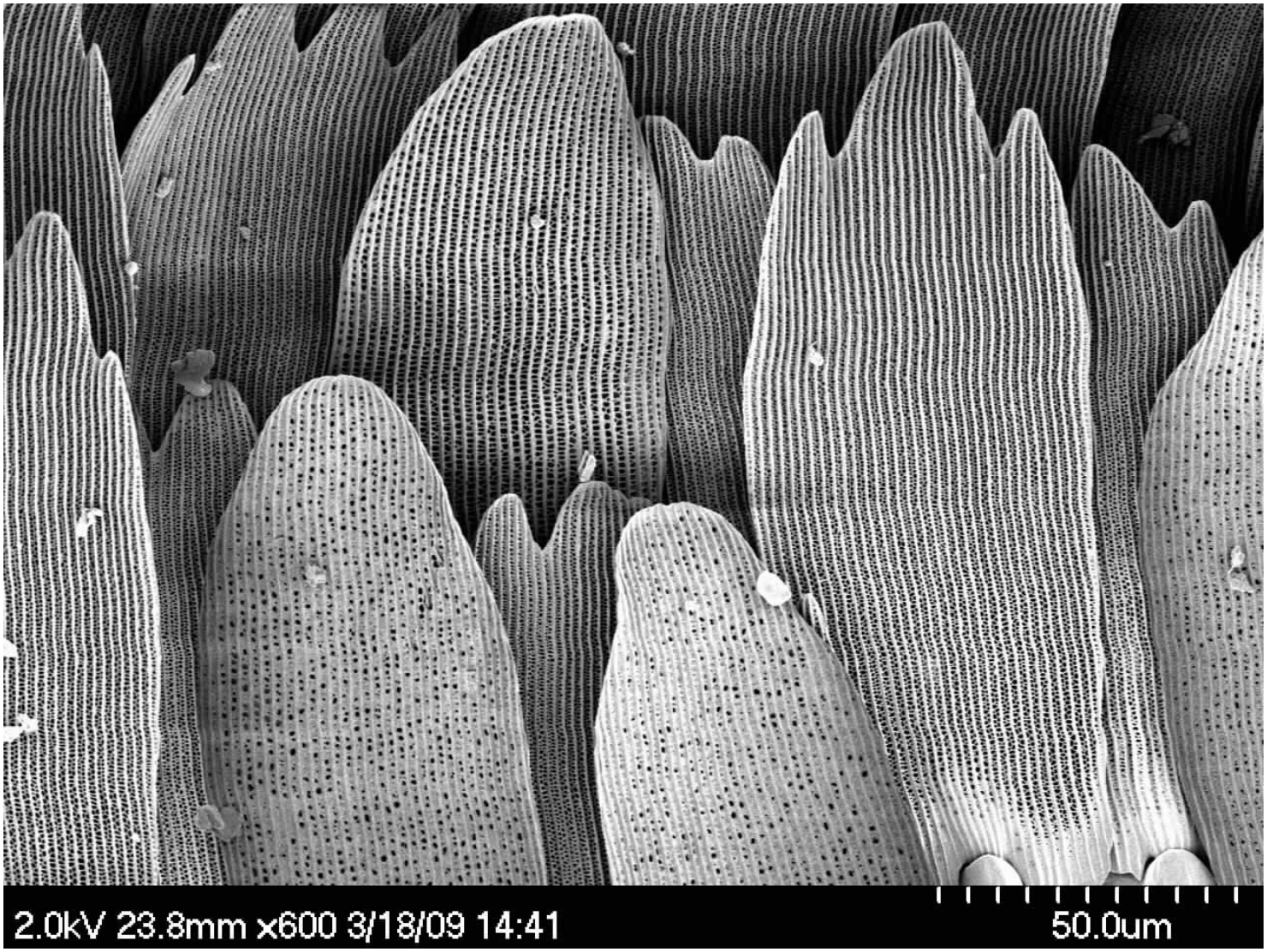
speedo



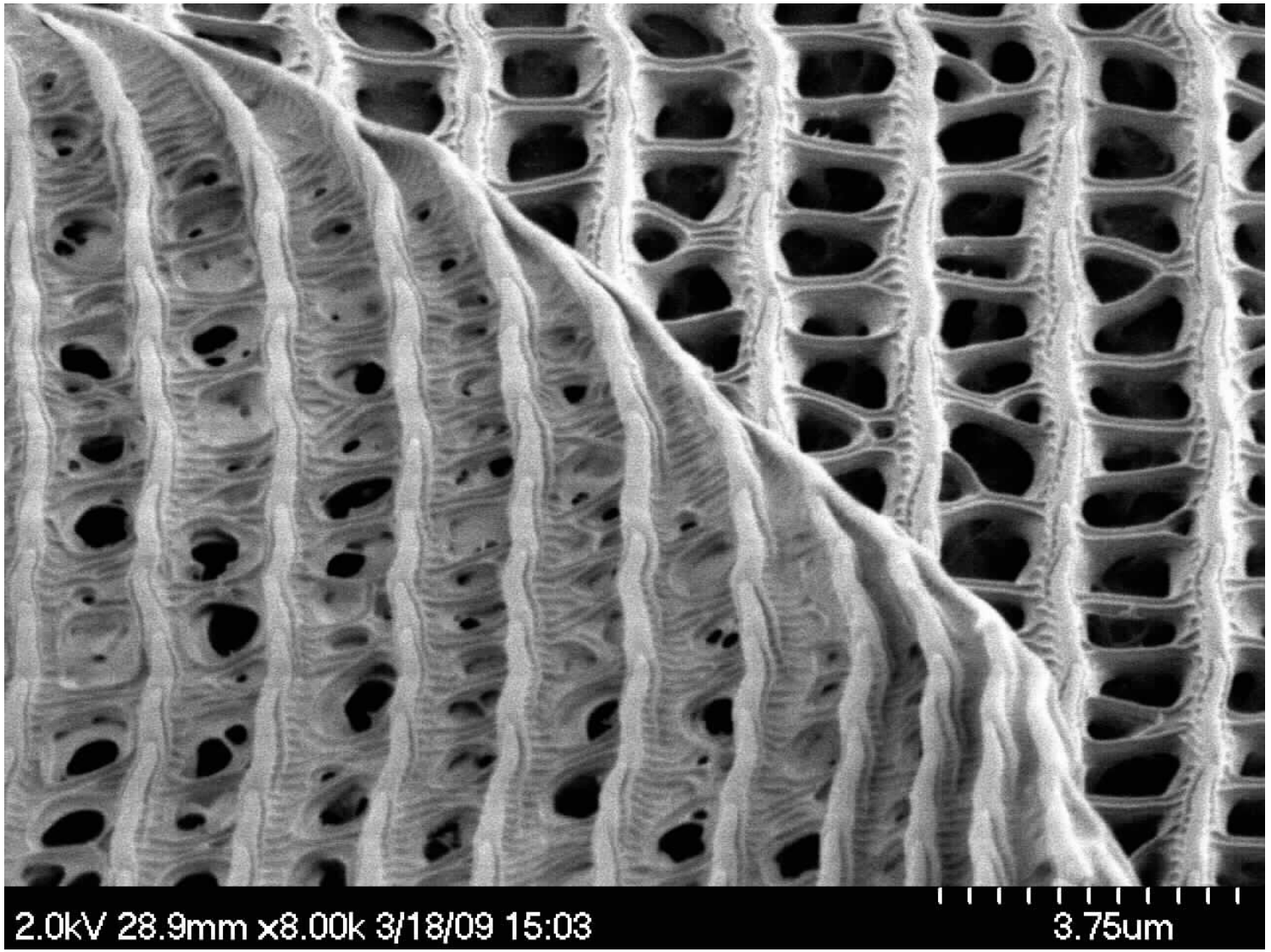
Sharklet™
Technologies, Inc.

To Dye For: Textile Processing's Global Impact

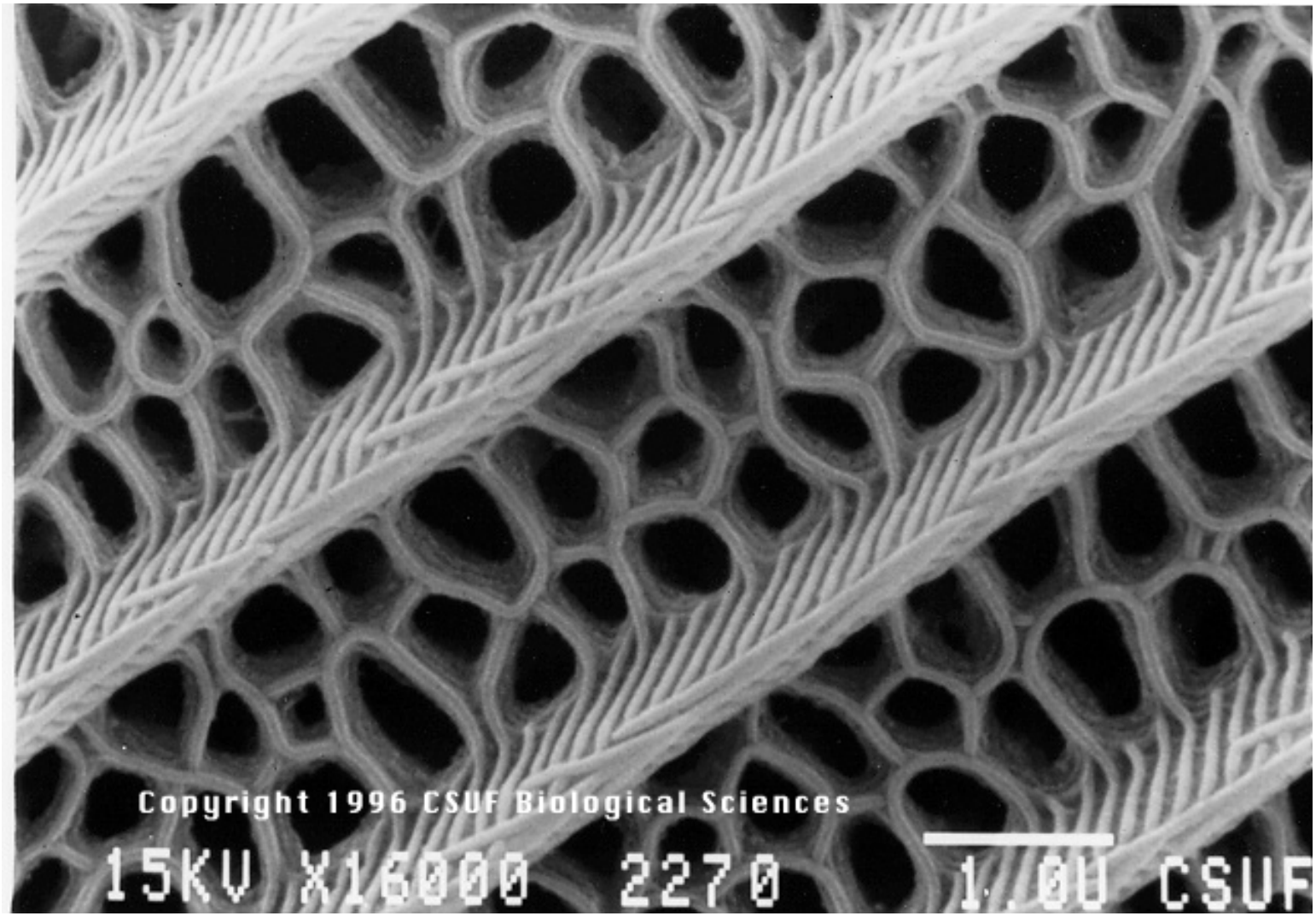

100 µm



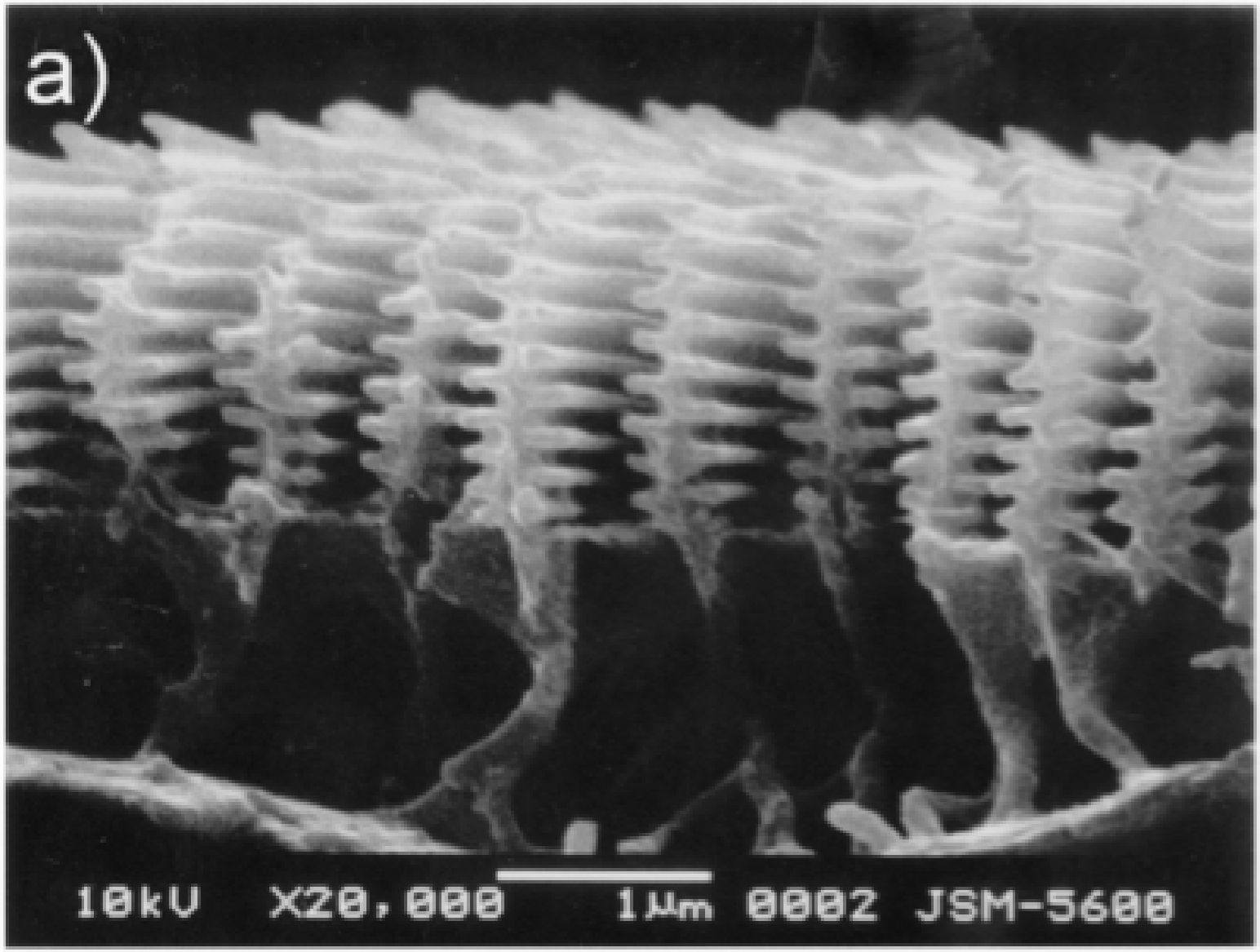
600 X magnification



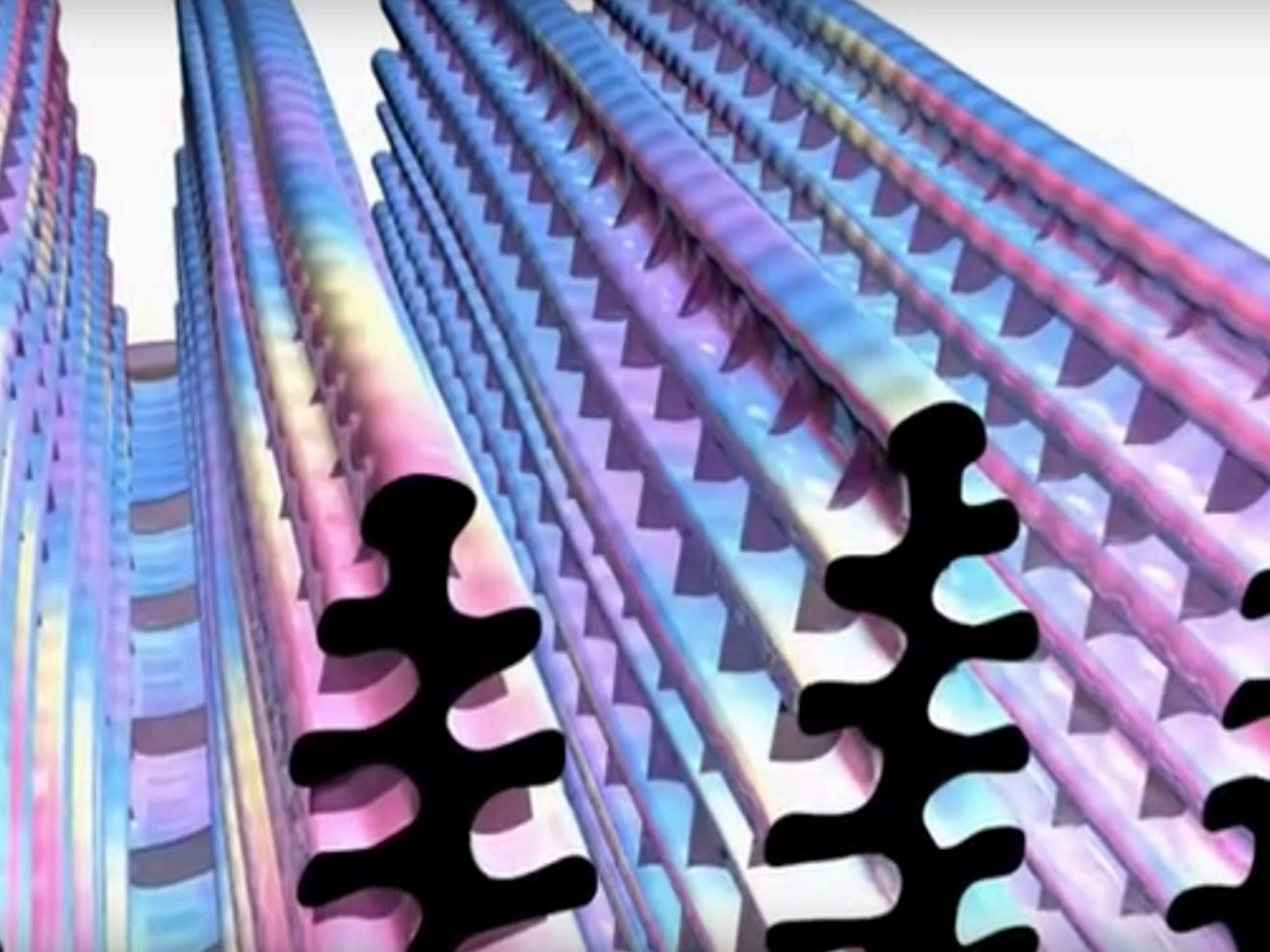
8000 X times

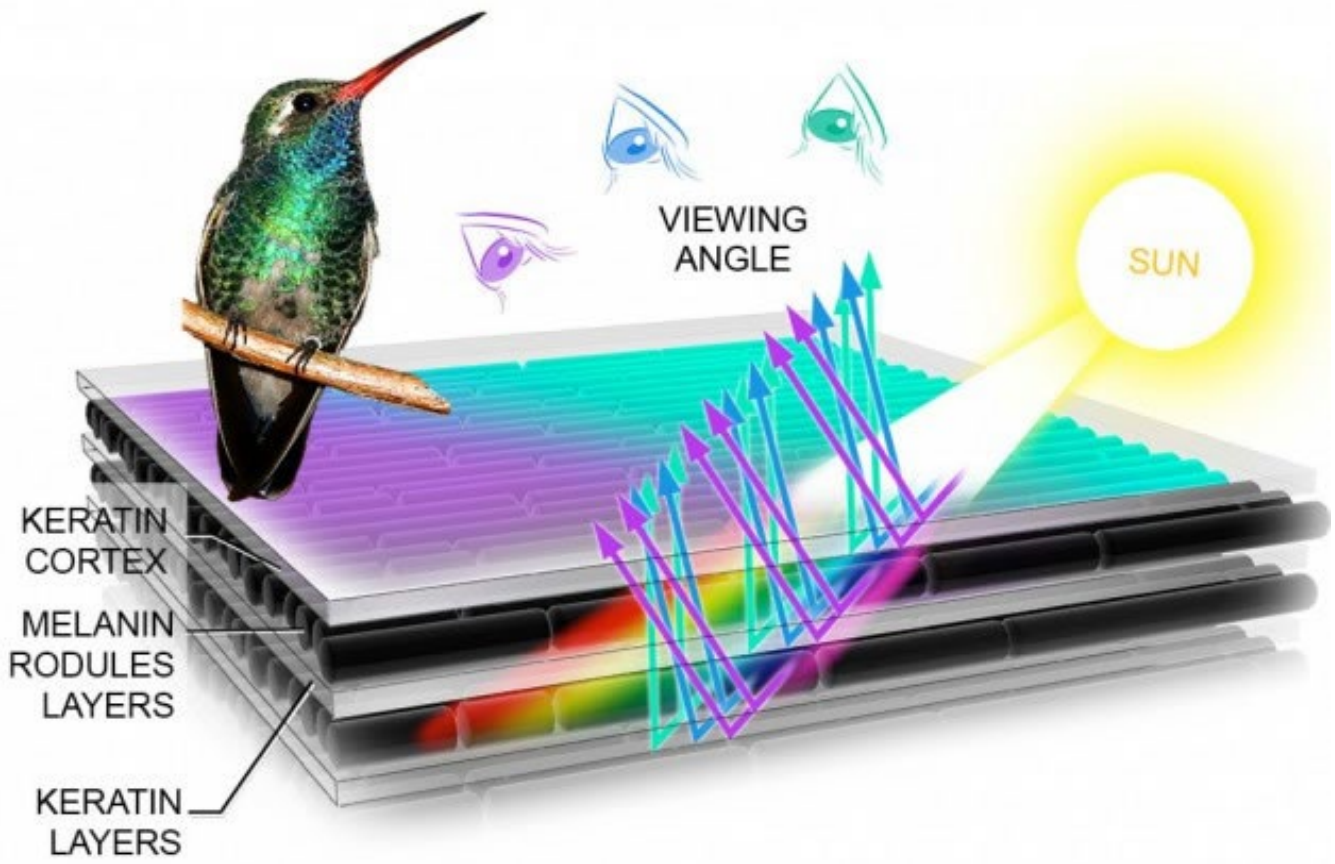


16.000 X times



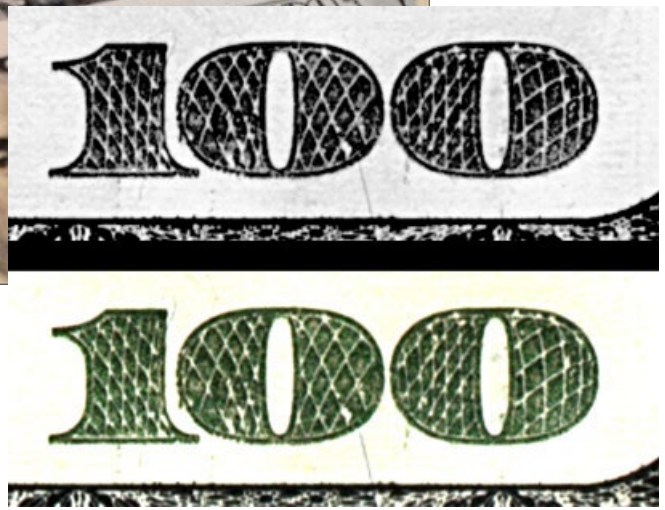
20.000 X times

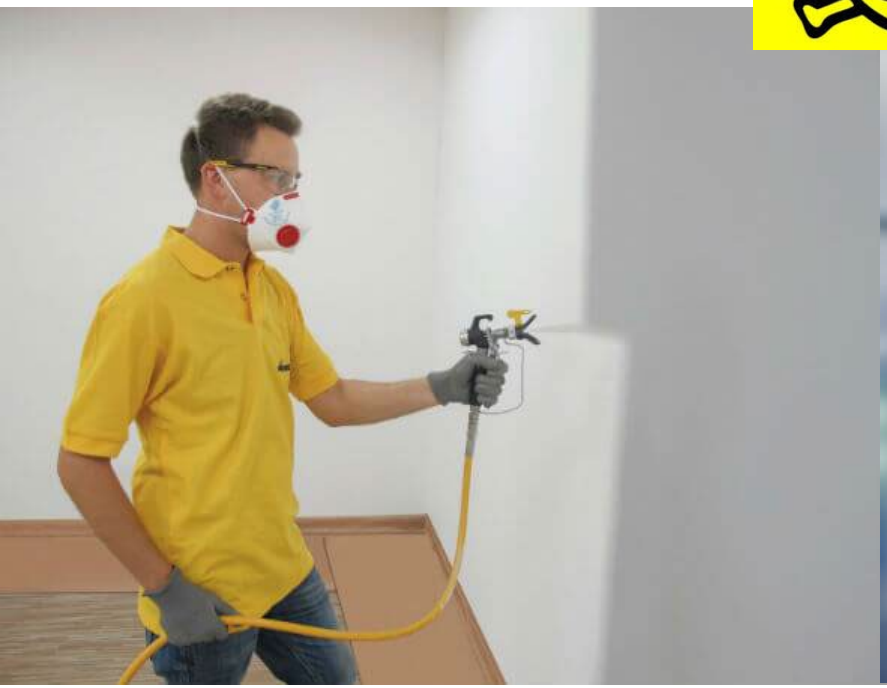




Color estructural


6:22
MOTOROLA
6:22


100
100




DESIGN MASTER
COLORTOOL® SPRAY
Versatile Surface Color
Turquoise
QUICK DRYING, SATIN FINISH
Color de la Superficie Versátil
Turquesa
SECADO RÁPIDO, ACABADO SATINADO
DESIGN MASTER
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Olive Bright
QUICK DRYING, SATIN FINISH
Color de la Superficie Versátil
Verde Oliva Fuerte
SECADO RÁPIDO, ACABADO SATINADO
DESIGN MASTER
COLORTOOL® SPRAY
Mandarina
DESIGN MASTER
COLORTOOL® SPRAY
Versatile Surface Color
Aspen Yellow
QUICK DRYING, SATIN FINISH
Color de la Superficie Versátil
Amarillo Álamo
SECADO RÁPIDO, ACABADO SATINADO
DESIGN MASTER
COLORTOOL® SPRAY
Versatile Surface Color
Pink Glow
QUICK DRYING, SATIN FINISH
Color de la Superficie Versátil
Brillo Rosado
SECADO RÁPIDO, ACABADO SATINADO

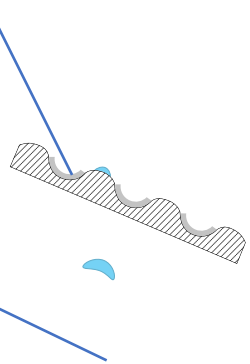
Desierto de Namibia

Escarabajo de Namibia

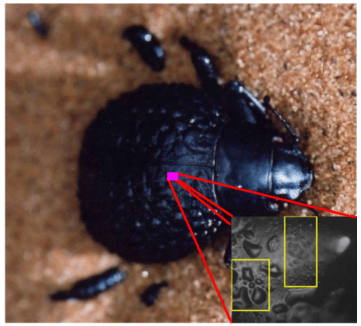
Stenocara gracilipes

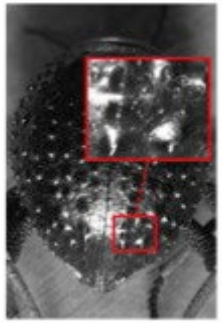
Repele agua
SUPERHIDROFOBICO

Atrae agua
SUPERHIDROFILICO



Escarabajo de Namibia





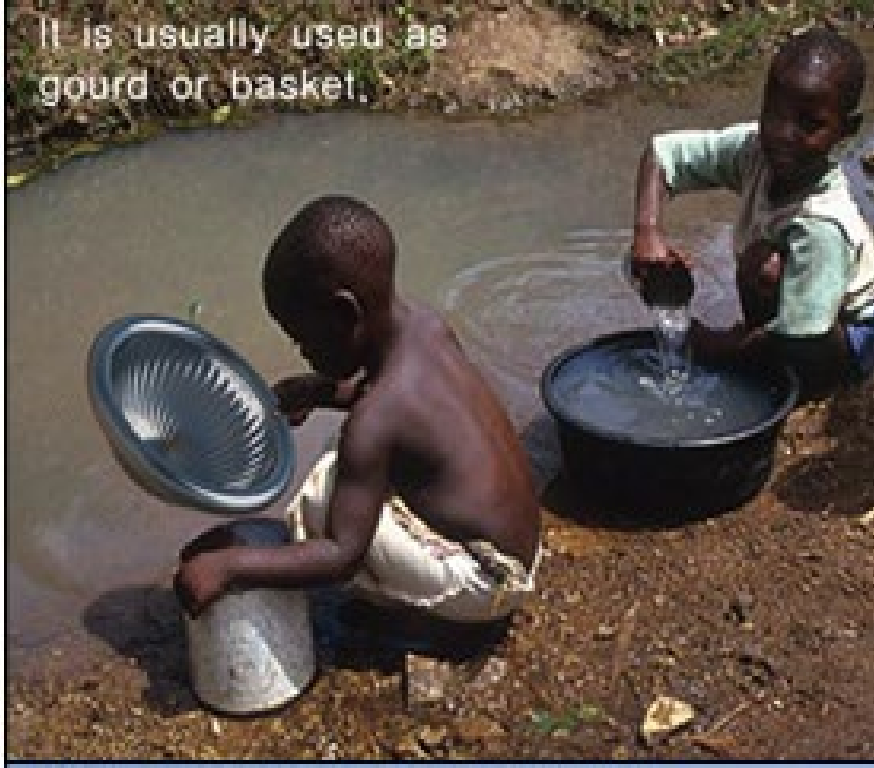
FogQuest
Sustainable Water Solutions

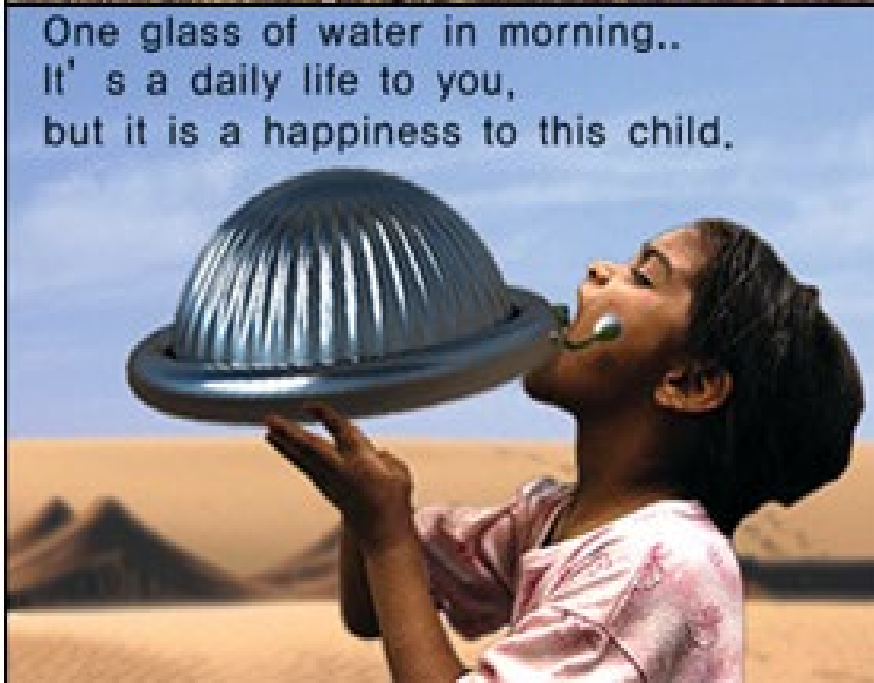
SAHARA
FOREST
PROJECT

nbd
nano

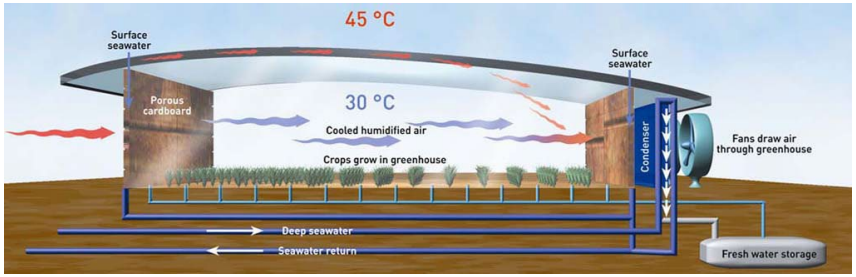
Dew Bank

Do you know the insect named as onymacris unguicularis? This insect is known for making dewdrop by using own body in desert. By being inspired from this mysterious onymacris unguicularis, we want to provide waters to residents in desert who wander for water.


It is usually used as
gourd or basket.


One glass of water in morning..
It' s a daily life to you,
but it is a happiness to this child.


1

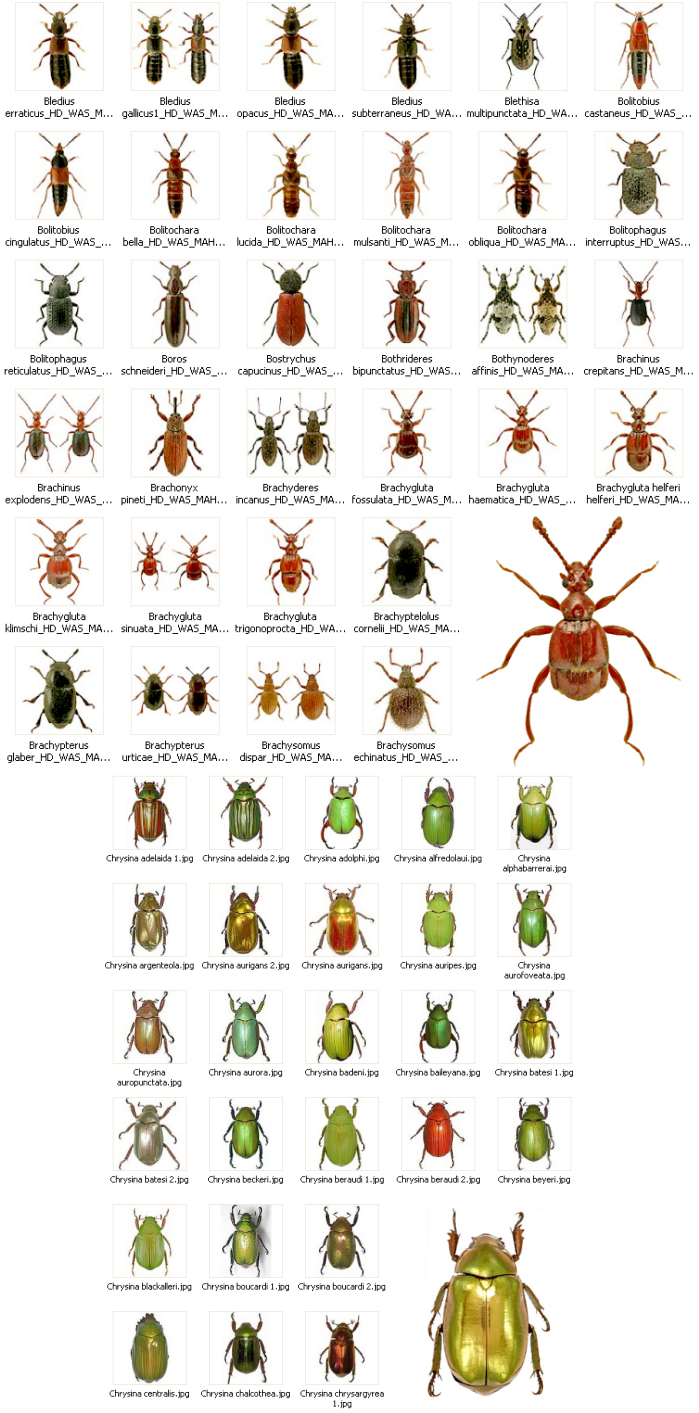

45 °C
Surface seawater
Surface seawater
Porous cardboard
30 °C
Cooled humidified air
Crops grow in greenhouse
Condenser
Fans draw air through greenhouse
Deep seawater
Seawater return
Fresh water storage

aqualonis

Os imagináis lo que

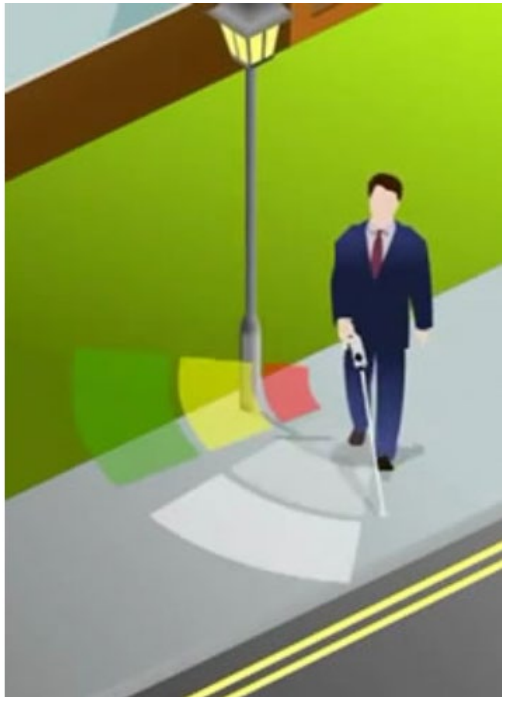
la Naturaleza

puede enseñarnos?

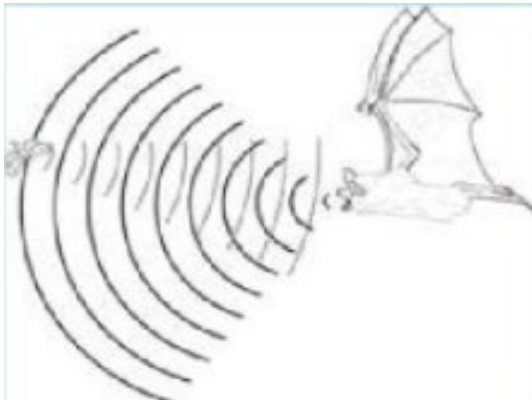


proceso

ONCE

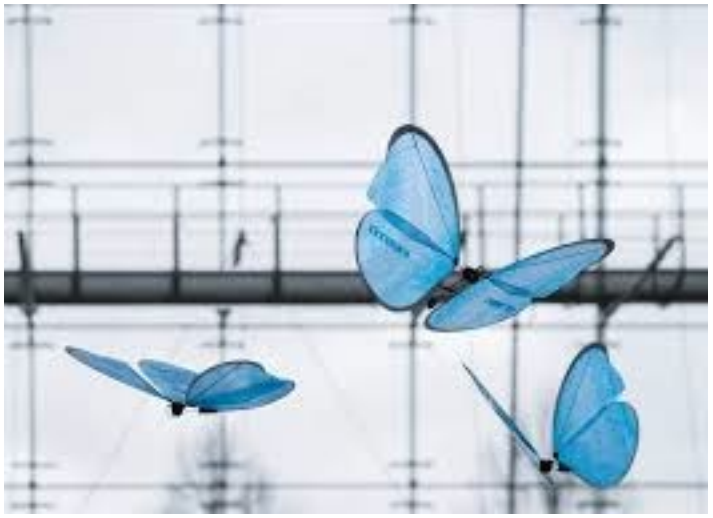


UltraCane

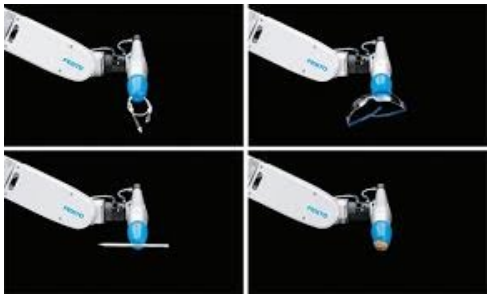



No quibble
30 day money
back guarantee!
Introducing the all new UltraCane...
UltraCane

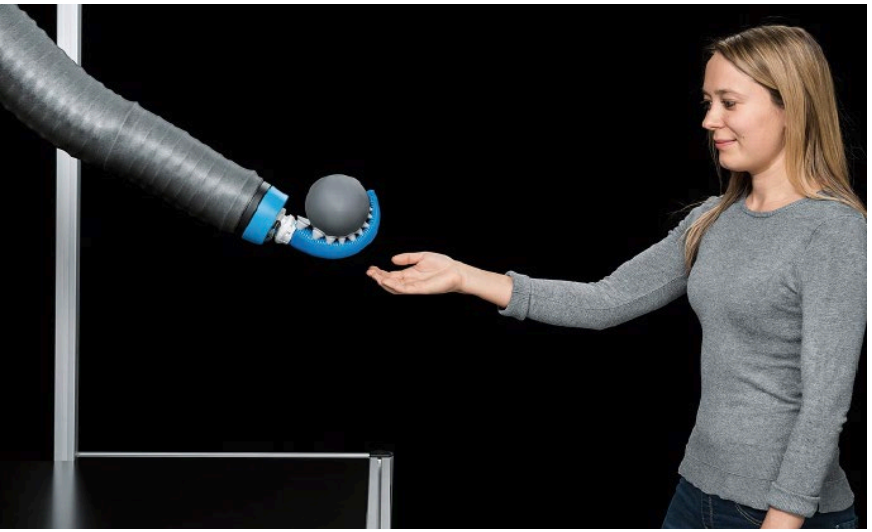
FESTO

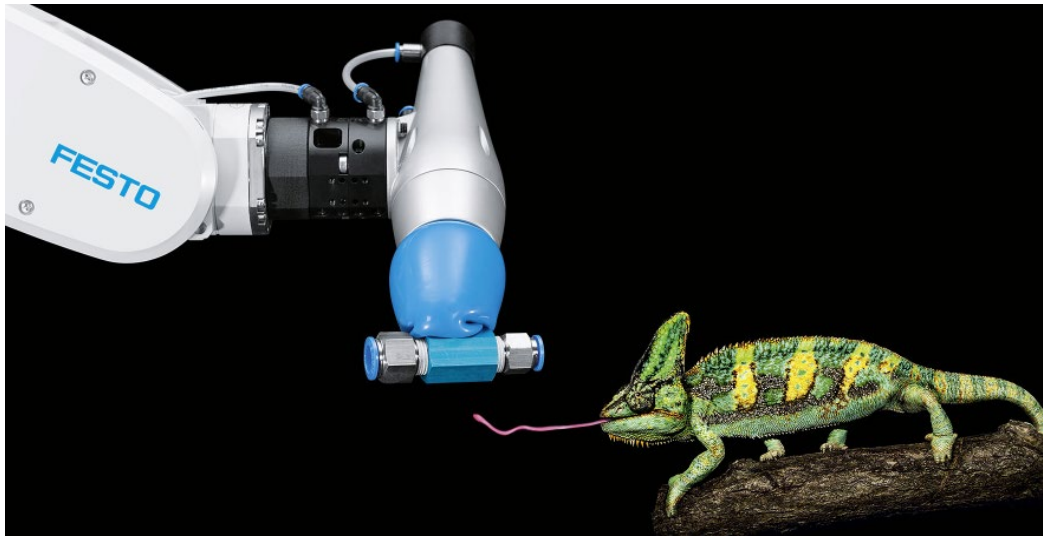


FESTO

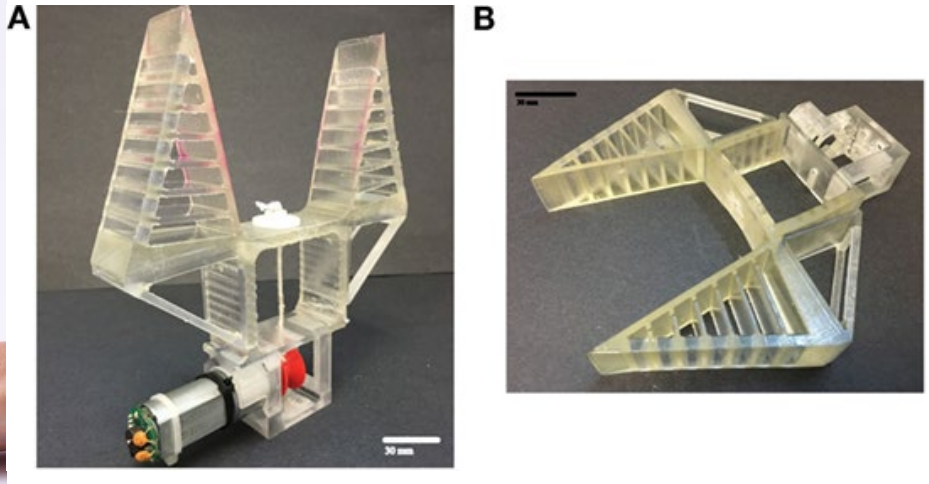


La forma se ajusta a la función

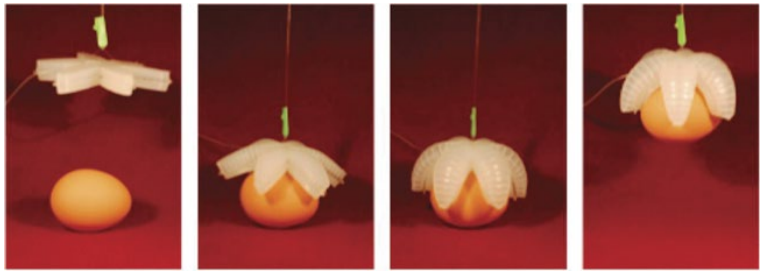




Bionictoys.de



Soft Robotic gripper

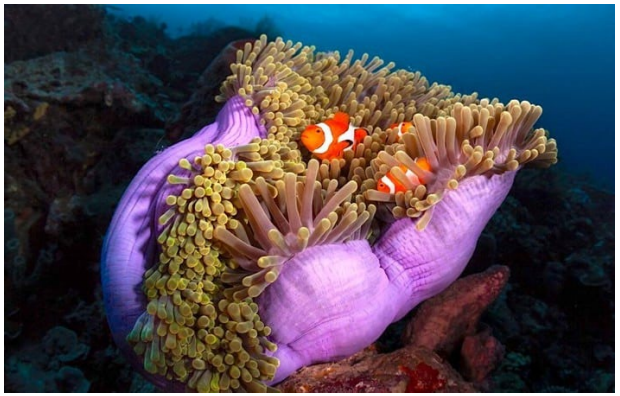


George Whiteside de Harvard

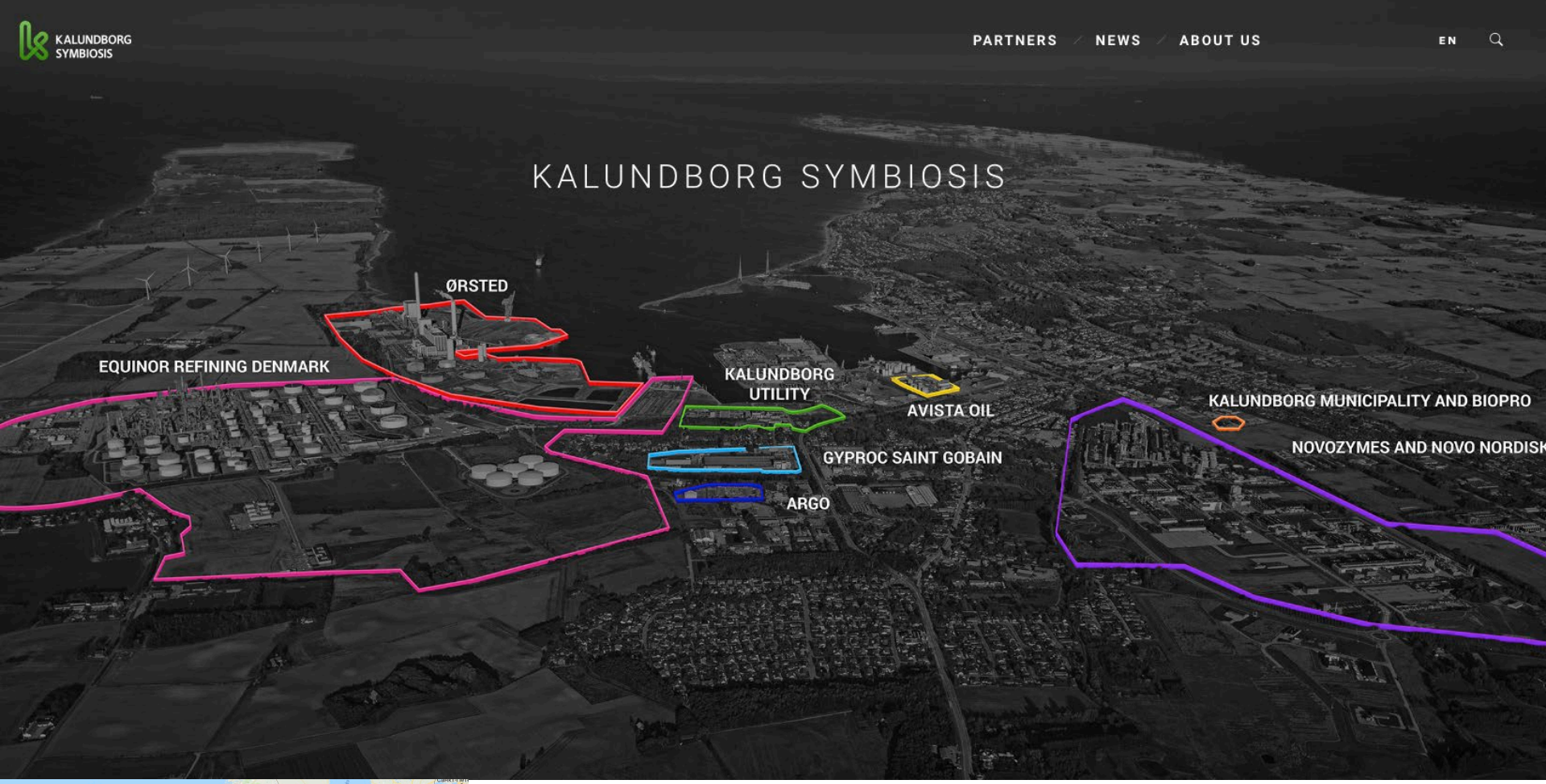
A escala de SISTEMA

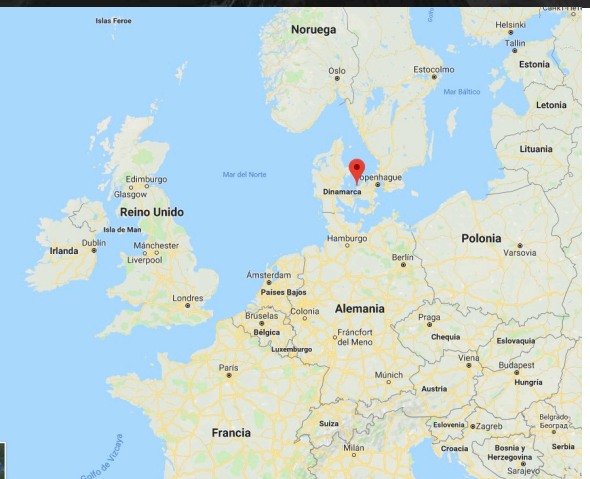
Ecología Industrial o Simbiosis Industrial

Economía Circular | Diseño Circular (C2C)

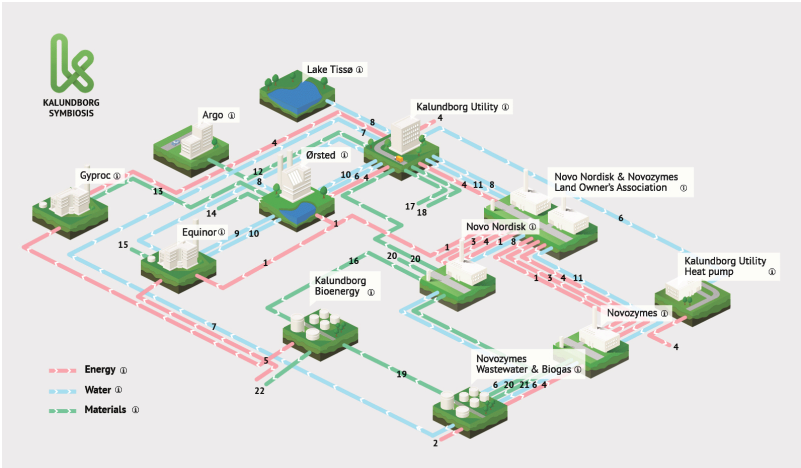


Interacciones de confianza entre 2 ó + especies
Muy frecuente en la Naturaleza

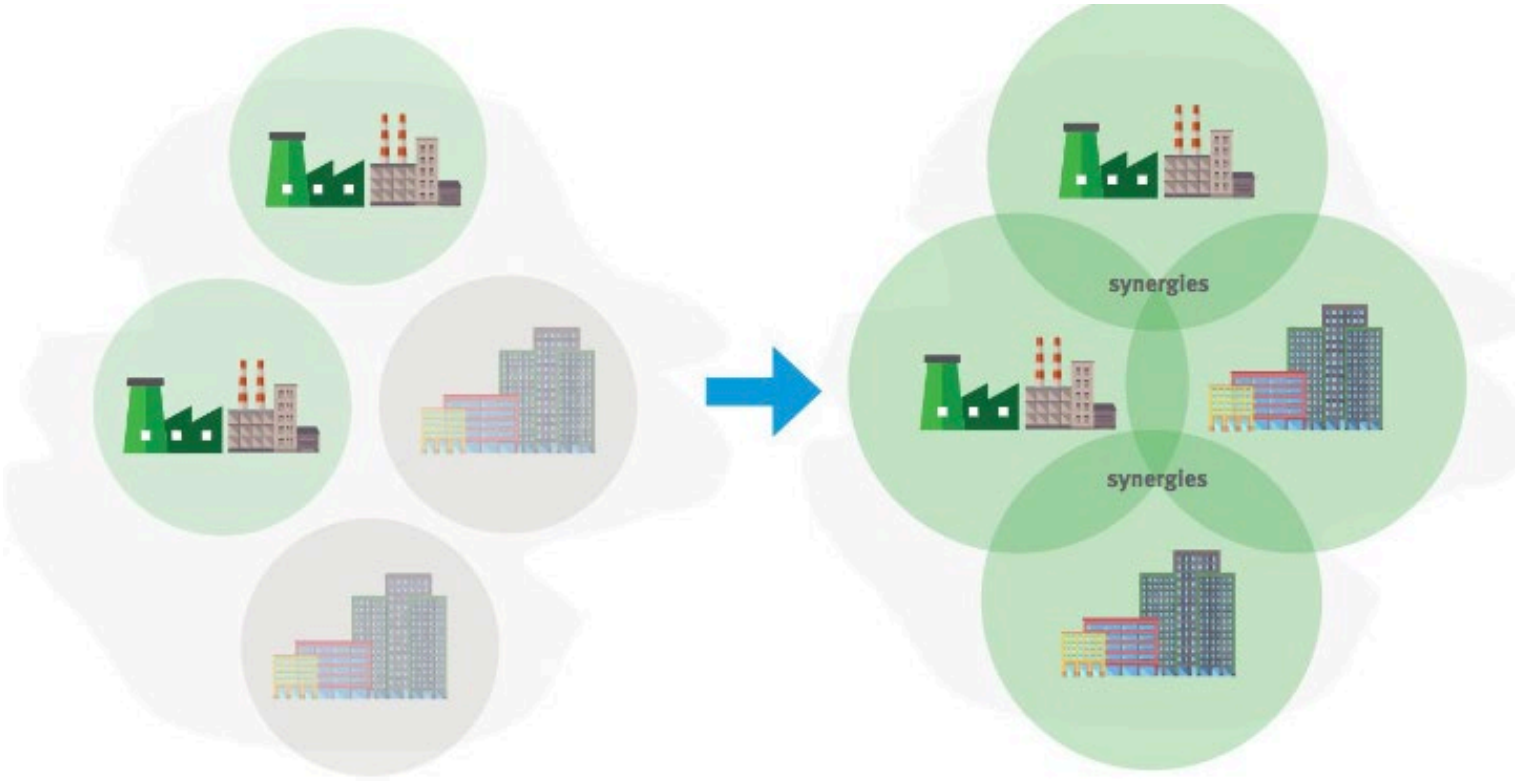




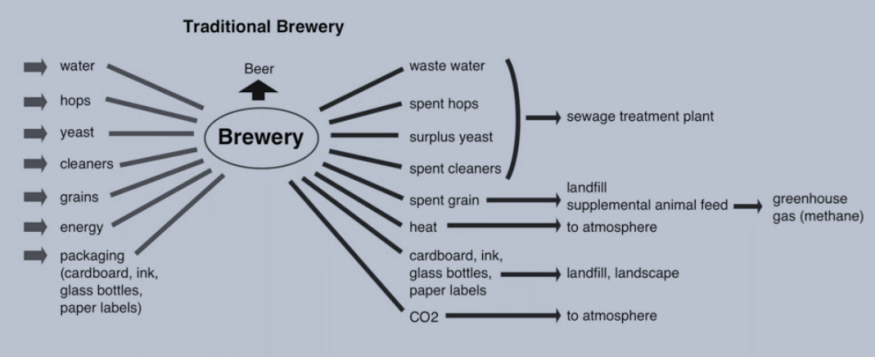
Kalunborg (Denmark)



Huella ecológica | Biocapacidad | Reducición/Eficiencia del uso de materiales y energía
Economía colaborativa | Basura 0 | Producción local



clásico natural



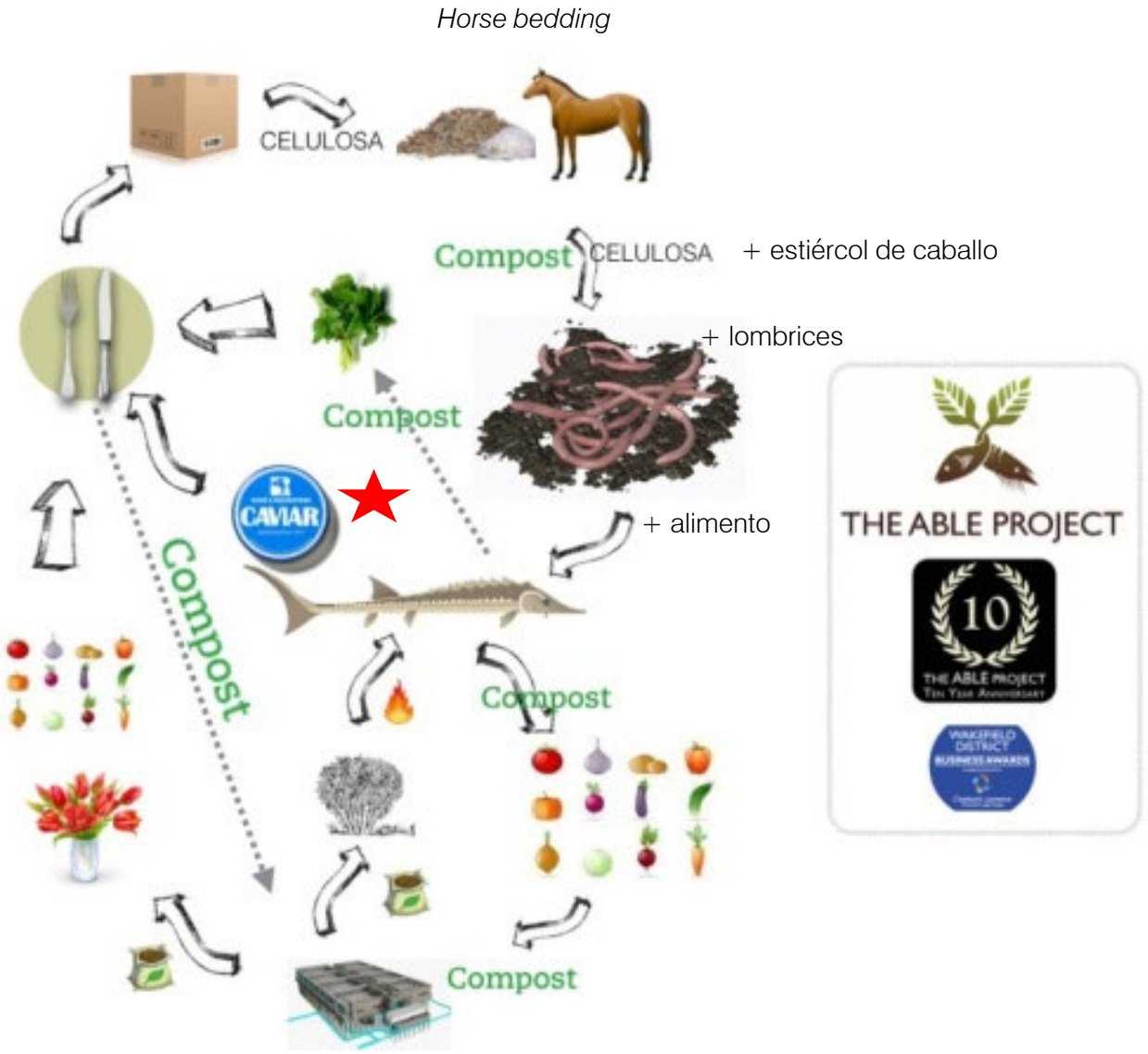
Cervecera Circular

?

0 € /K

6,000 €/K

Pensamiento sistémico a menor escala (barrio, municipio…)



Cuantos Residuos nos rodean…?

que no vemos…

+ 600 Millones de pinos cortados/año/UE

20-30% biomasa: espículas

Tamara Orjola makes furniture and textiles using pine needles

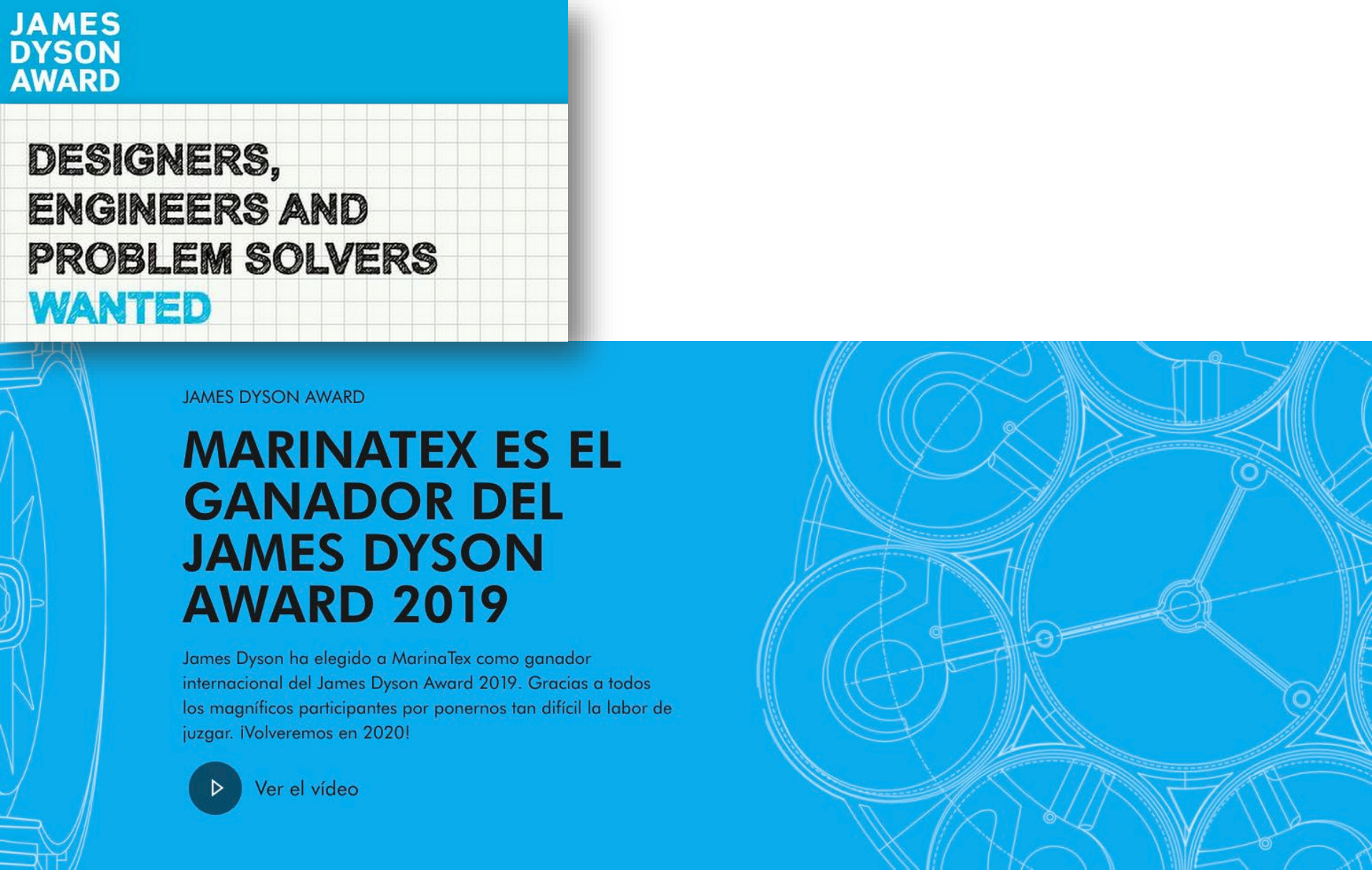
Emma Tucker | 7 November 2016 | 2 comments

Design Academy Eindhoven graduate Tamara Orjola's Forest Wool stools and carpets are made from processed pine needles left over from the timber industry.

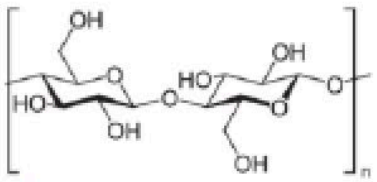
By crushing, soaking, steaming, binding and pressing the needles, Orjola extracts the pine needles' fibre and transforms it into textiles, composites and paper. The process also allows essential oils and dye to be extracted and used.

Muestrario de nuevos materiales

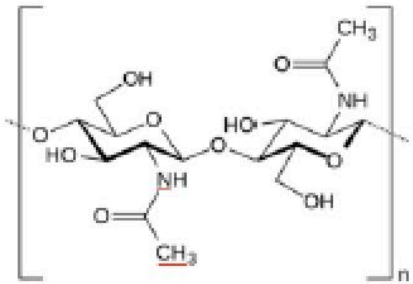
Socio?



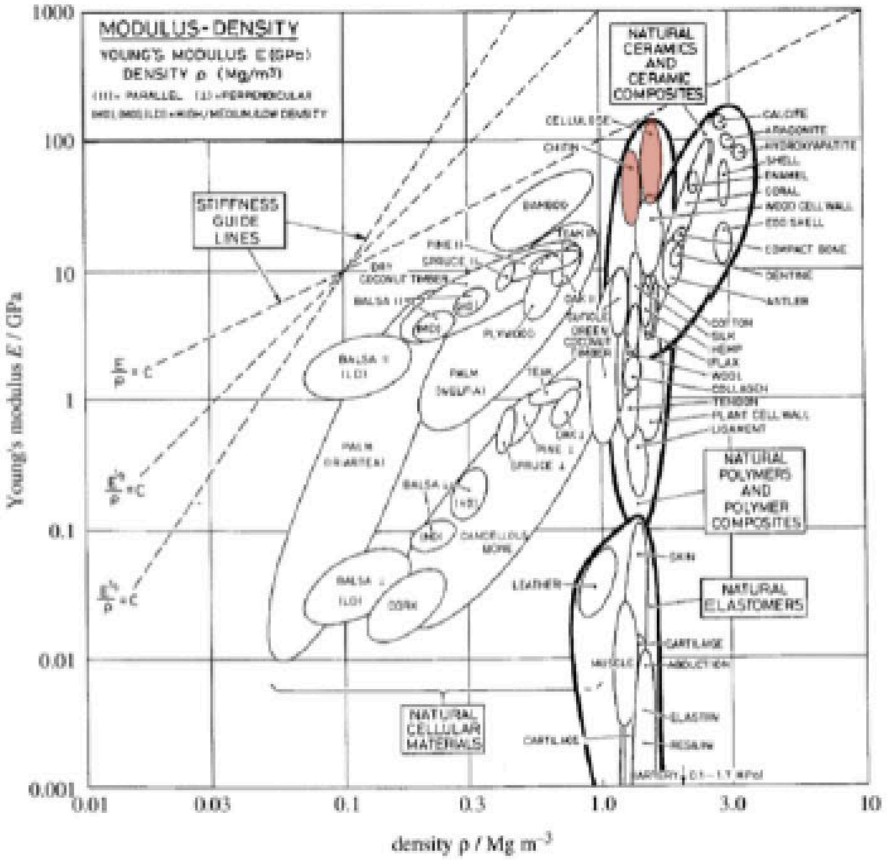
https://www.jamesdysonaward.org/es-ES/



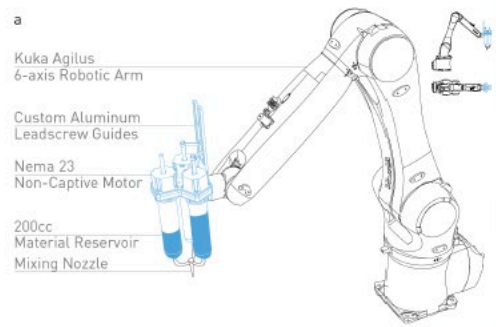
Cellulose

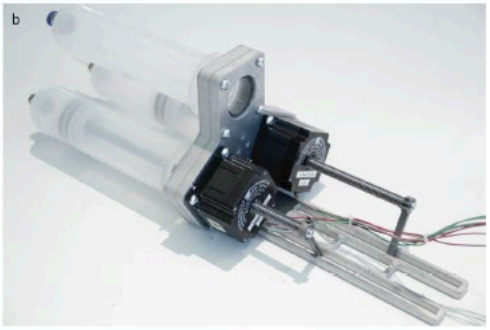


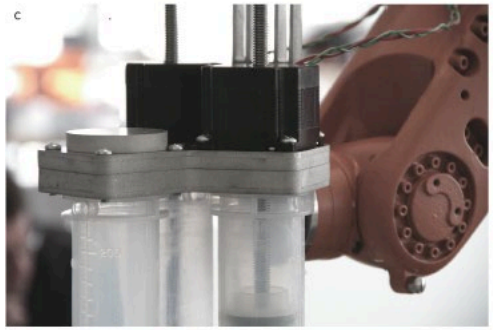
Chitin

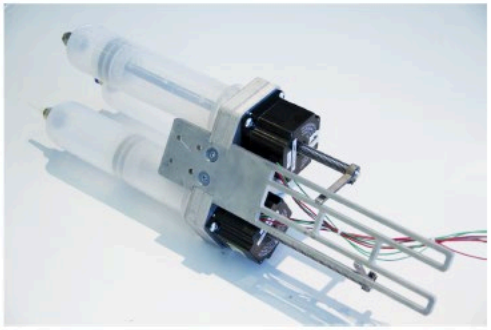


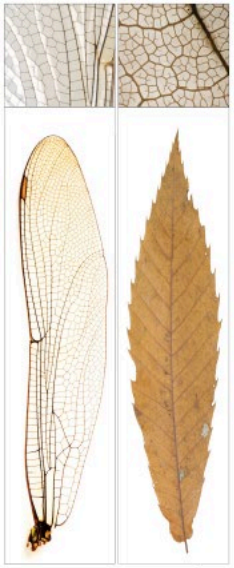
mit media lab



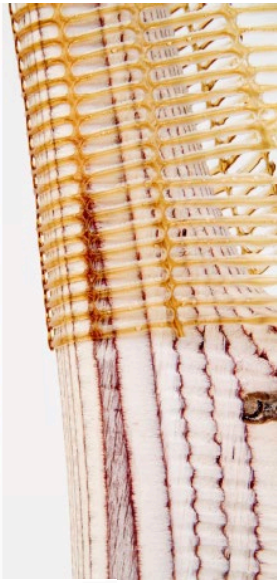


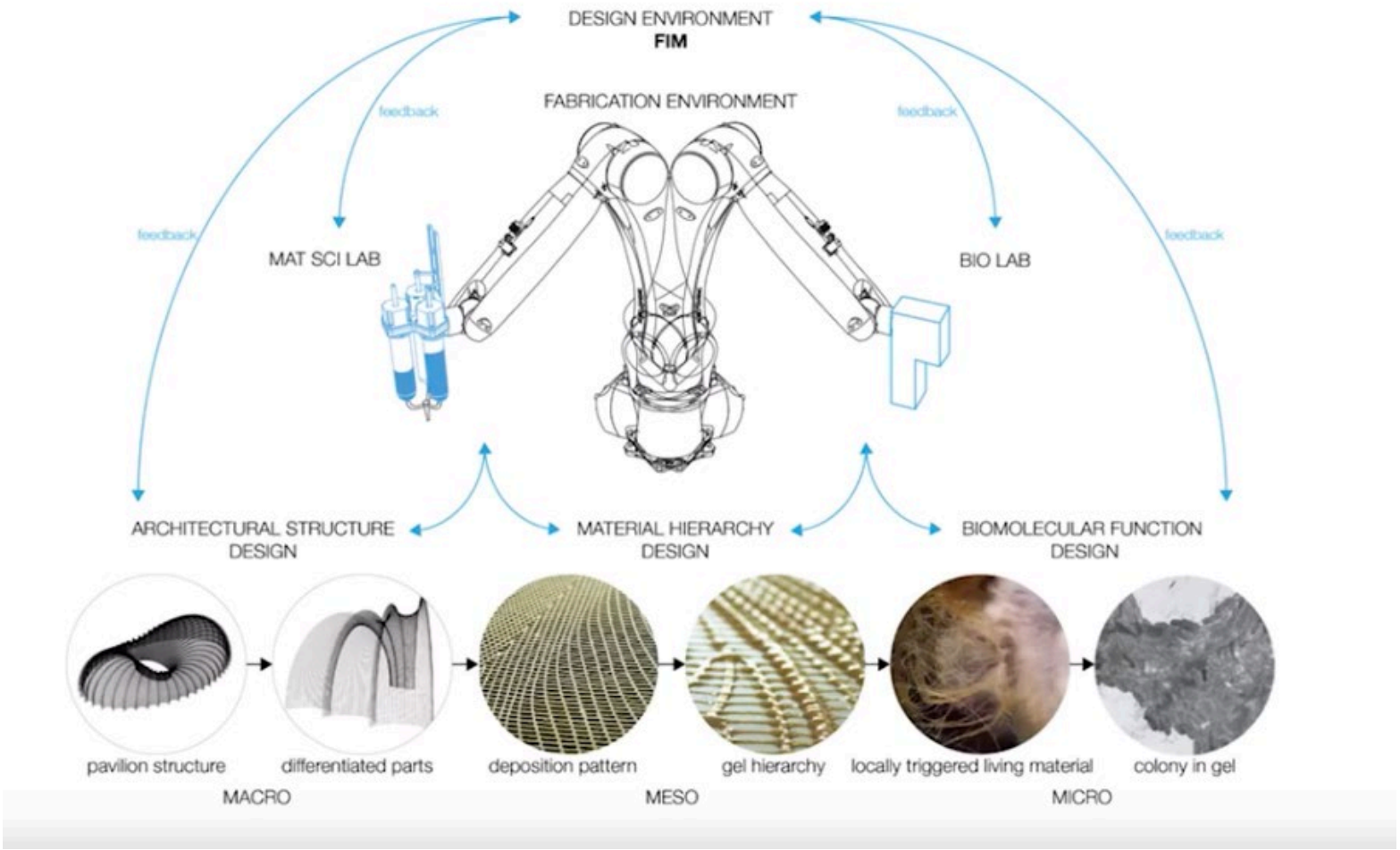


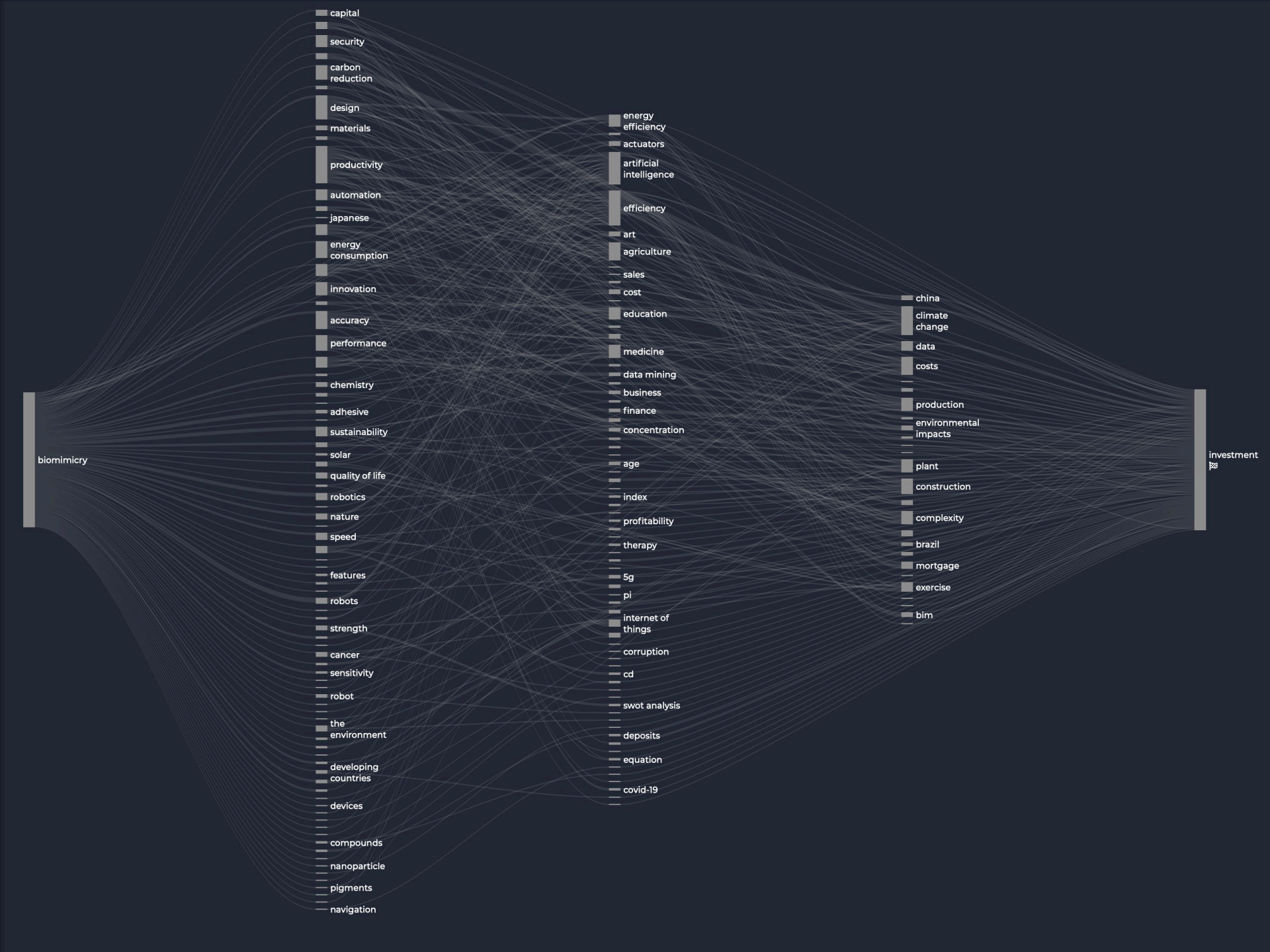





b




DESIGN ENVIRONMENT
FIM
FABRICATION ENVIRONMENT
feedback
feedback
feedback
feedback
MAT SCI LAB
BIO LAB
ARCHITECTURAL STRUCTURE DESIGN
MATERIAL HIERARCHY DESIGN
BIOMOLECULAR FUNCTION DESIGN
pavilion structure
differentiated parts
deposition pattern
gel hierarchy
locally triggered living material
colony in gel
MACRO
MESO
MICRO


biomimicry
capital
security
carbon reduction
design
materials
productivity
automation
japanese
energy consumption
innovation
accuracy
performance
chemistry
adhesive
sustainability
solar
quality of life
robotics
nature
speed
features
robots
strength
cancer
sensitivity
robot
the environment
developing countries
devices
compounds
nanoparticle
pigments
navigation
energy efficiency
actuators
artificial intelligence
efficiency
art
agriculture
sales
cost
education
medicine
data mining
business
finance
concentration
age
index
profitability
therapy
5g
pi
internet of things
corruption
cd
swot analysis
deposits
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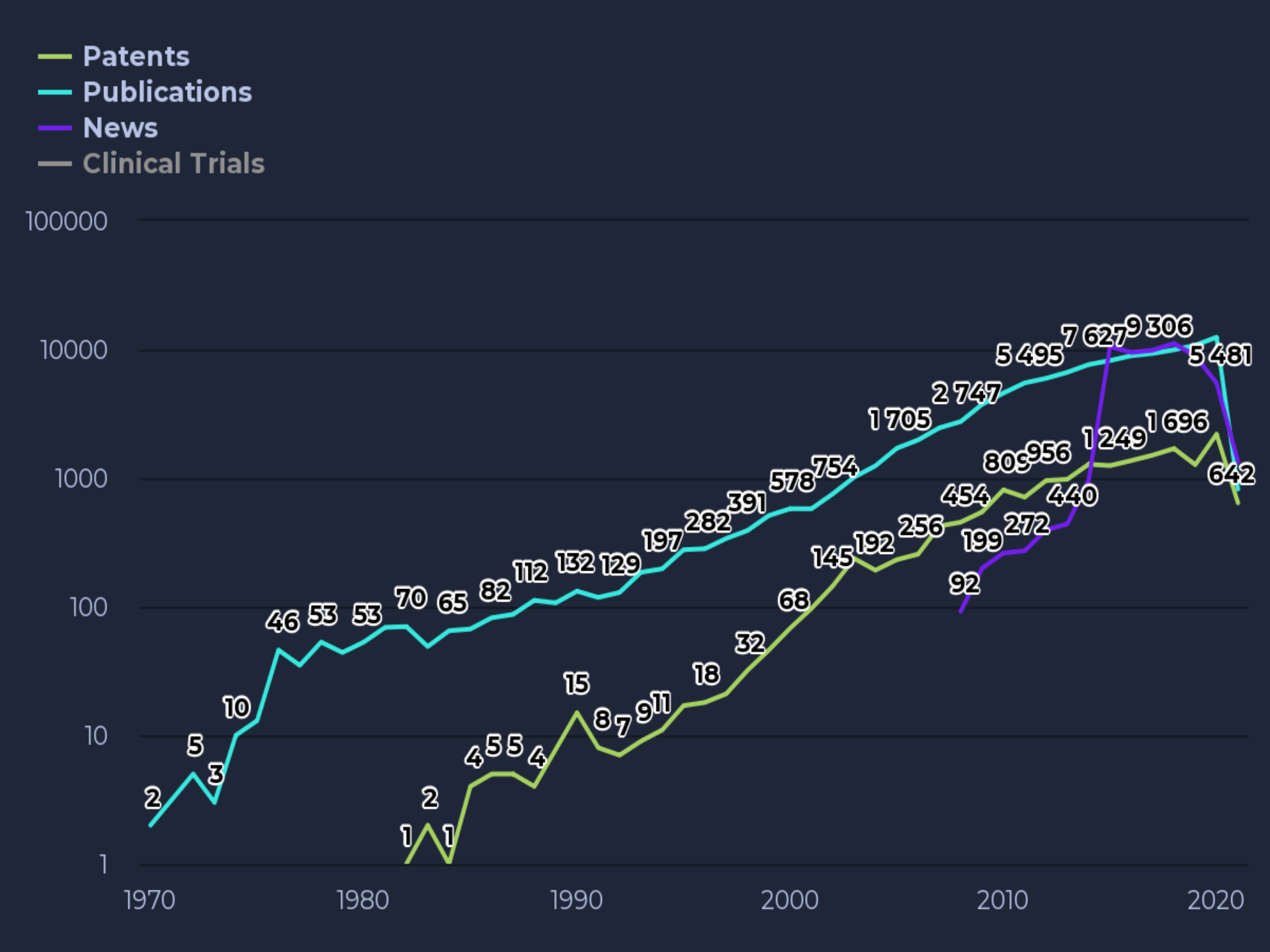
Patents
Publications
News
Clinical Trials
100000
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1970
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2010
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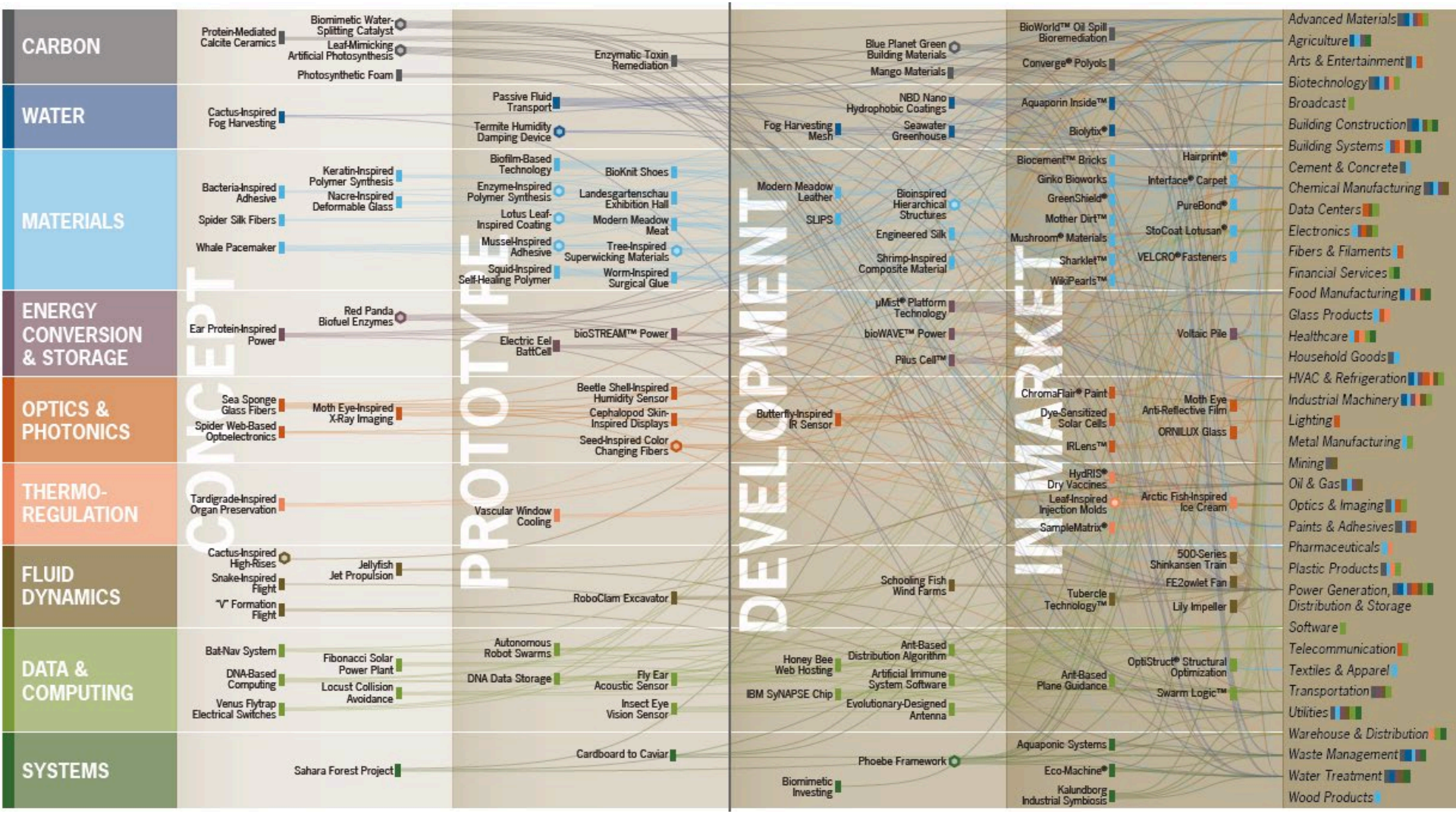
1 696
92
199
272
440

Biomimesis aplicada en + 40 sectores industriales



nature inspire us

TERRAPIN
BRIGHT GREEN

Santander X Innovation Xperts

Biomímesis:

la innovación sostenible y regenerativa inspirada en la naturaleza.

ENERO 2023 MANUEL QUIRÓS

By Santander